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Chemical Materials Agency
Program Manager for the Elimination of Chemical Weapons

Product Manager for Non-Stockpile Chemical Materiel

Health and Safety Plan for the Explosive Destruction System Deployment to Dugway Proving Ground, Utah

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Revision 0

March 2004

HEALTH AND SAFETY PLAN FOR THE EXPLOSIVE DESTRUCTION SYSTEM DEPLOYMENT TO DUGWAY PROVING GROUND

March 2004

Approval Page

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EXPLOSIVE DESTRUCTION SYSTEM
DEPLOYMENT TO DUGWAY PROVING GROUND

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SECTION 1
INTRODUCTION

This Health and Safety Plan (HASP) was written to support the Explosive Destruction System (EDS) deployment to the Dugway Proving Ground (DPG), Utah, to destroy recovered chemical warfare munitions and Department of Transportation (DOT) cylinders and to treat the chemical fill materiel. Figure 1-1 shows the location of the EDS site relative to nearby features. This HASP was written as a site-specific plan for safe operation of the EDS. This plan is based on the previous HASP developed to support the EDS Phase 1 program for the Product Manager for Non-Stockpile Chemical Materiel (PMNSCM).

The HASP was developed in accordance with Occupational Safety and Health Administration (OSHA) regulation 29 Code of Federal Regulations (CFR) 1910.120, *Hazardous Waste Operations and Emergency Response*.

The EDS is a transportable total containment system designed for the treatment of recovered chemical munitions that are deemed unsafe for transport or long-term storage or for treatment of munitions when use of other disposal systems is not feasible. The EDS can also be used for munitions that are considered safe for normal handling. The EDS uses explosives to access a chemical munition and destroy the munition's explosive components. Figure 1-2 shows the EDS layout for field operations.

1.1 EDS Description

The EDS is designed to access munitions that meet all the following criteria:

a. Range from a 75 millimeter (mm) projectile to a Livens projectile (approximately 8 inches in diameter)

b. Containing 28 pounds or less of chemical fill

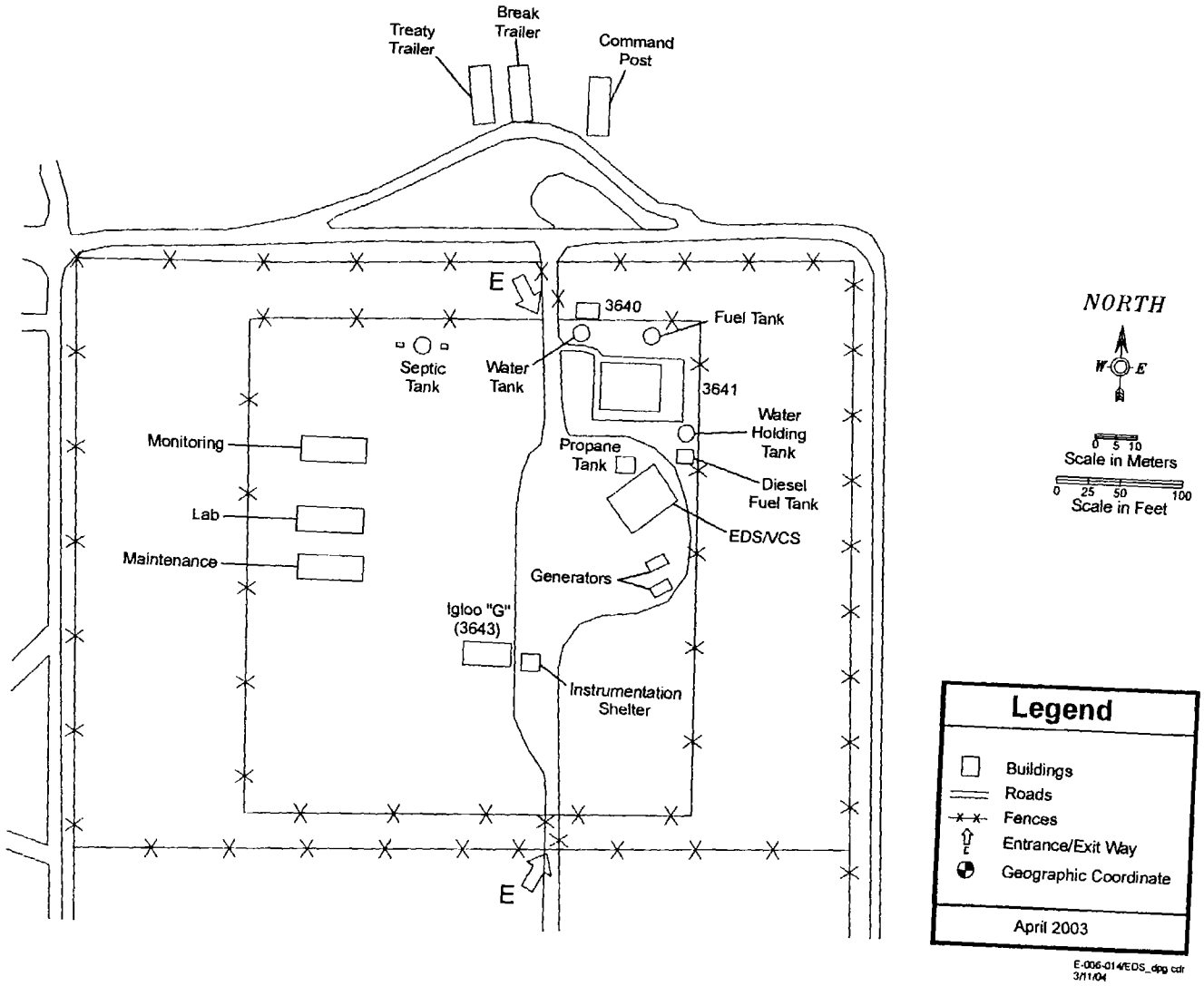

Figure 1-1. Location of EDS Site Relative to Nearby Features

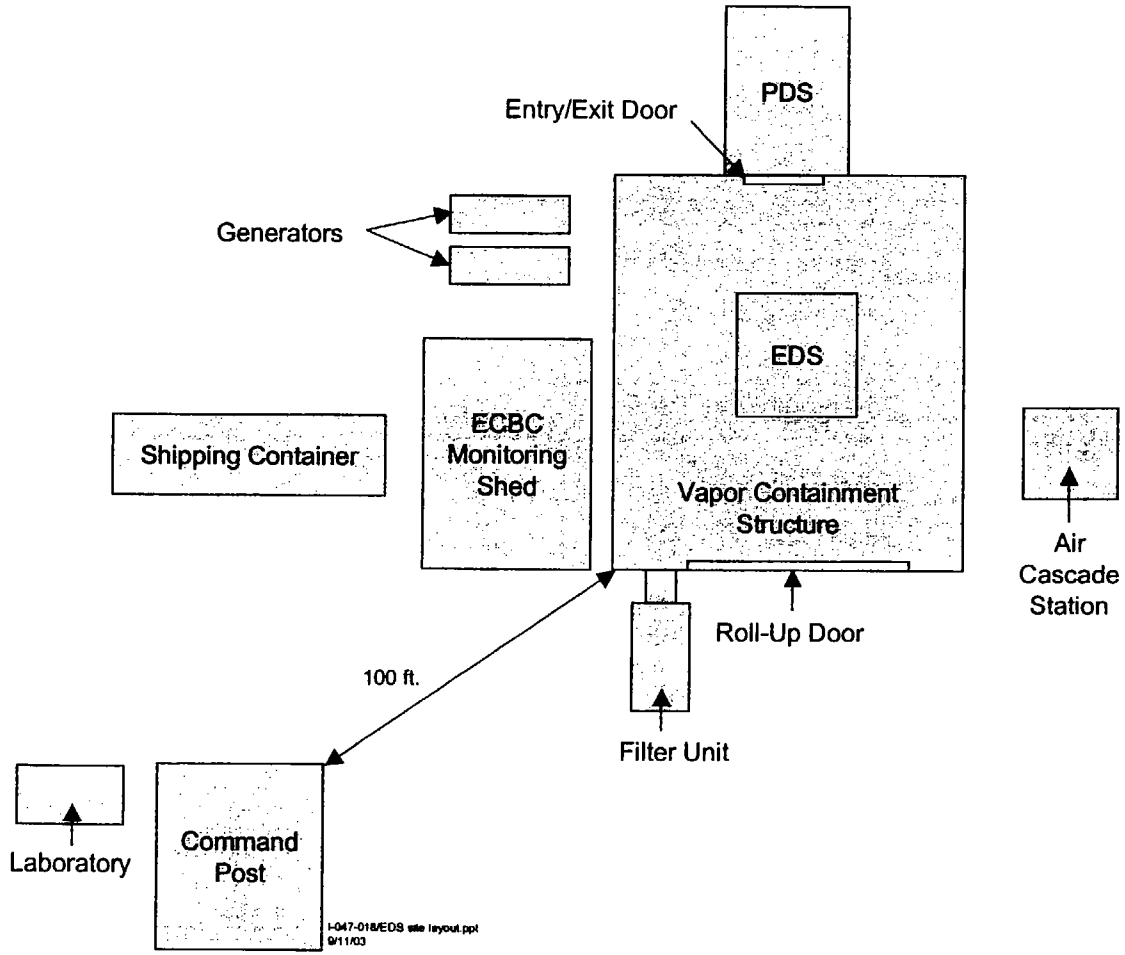

Figure 1-2. Layout of the EDS Site

c. May or may not have explosive components

d. Have up to approximately 1/2-pound trinitrotoluene (TNT) equivalent explosives whereby the total net explosive weight does not exceed the 1-pound capacity for the vessel.

The EDS is comprised of the following major components:

- Trailer
- Explosion containment vessel
- Leak detector
- Reagent supply system
- Waste handling system
- Hydraulic system
- Firing system
- Electrical system.

EDS operations include the following system subcomponents:

- Vapor Containment System (VCS)
- Maintenance Trailer.

1.2 Functional Description of the EDS

EDS operations at DPG may be carried out using the EDS Phase 1 Unit 3 (P1U3). For the remainder of this document, the system will be referred to as the EDS.

1.2.1 Chemical Treatment. The reagent used to treat the mustard (H)-filled items will be 90 percent by volume monoethanolamine (MEA)/10 percent by volume water (hereafter referred to as 90 percent MEA reagent). The reagent used to treat sarin (GB)-filled items will be 45 percent by volume MEA/55 percent by volume water (hereafter referred to as 45 percent MEA reagent). The treatment reactions are exothermic. Some reactions can generate significant energy; however, with the large thermal mass of the thick-walled vessel, the heat of the reaction only aids in warming the vessel and does not create dangerous pressures.

Treatment of the chemical agent and decontamination of the munition or DOT cylinder fragments are accomplished within the sealed vessel.

1.2.2 Preparation for Next Item. Before treatment of each subsequent item[1], the vessel is systematically cleaned and inspected. This process includes visually inspecting the vessel, the sealing surface, and the door; making any necessary repairs; replacing the door seal and ethylene propylene diene monomer (EPDM) O-ring on the vessel door; and replacing the electrical feedthroughs, as necessary.

1.2.3 Closeout. Upon completion of operations, the EDS is closed out. Closeout activities include cleaning and decontaminating the vessel and equipment, stowing all equipment and supplies, transferring hazardous waste to an approved treatment, storage, and disposal facility (TSDF) (or arranging for its transfer), and preparing the EDS for transport from the treatment location.

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[1] The plan is to process each item separately. It is possible that more than one item may be processed at a time if the fills of the items are the same and the quantity of explosives placed in the EDS do not exceed the design limitation. Processing more than one item at a time will not be performed unless approvals are obtained from the Army and State regulators.

1.3 Description of Major Subcomponents

1.3.1 VCS. The EDS will be housed inside the VCS. The VCS has a carbon-filtered exhaust system to maintain a negative pressure within the structure relative to the outside air and to capture any agent vapors that may result from a release of agent while an item is being prepared for placement in the vessel.

The VCS will be 30 feet wide by 50 feet long by 16 feet 10 inches high. The structure is assembled by bolting together 2-foot by 10-foot preformed 14 gauge Galvalume panels that are also bolted to a W8 x 18 steel beam base. The steel beam base is placed on a sandbag foundation to ensure a stable foundation and a good seal with the ground. The structure is equipped with a 12-foot by 12-foot roll-up door centered in one end. There also is a standard personnel door on both ends of the structure. There is a 2-foot circular opening in one end of the arch for connection to the filtration system and there is a 3-foot by 3-foot louvered opening in the opposite end of the structure for providing makeup air. The floor of the VCS will be leveled ground covered with heavy plastic sheeting that will contain any spills.

The exhaust filtration system for the VCS consists of pre-filters, high efficiency particulate air (HEPA) filters, and carbon filters along with a motor, fan, and ductwork. Operation of the exhaust system will be monitored by pressure gauges that measure head loss across the filters. If head loss across a filter exceeds a predetermined limit (specified in the manufacturer's literature), then that filter will be changed. If the pressure difference between the VCS and the outside air should fall below the specified limit, the system will be inspected and adjusted to correct any defective parts or settings. The carbon filter exhaust system in the VCS filtration system maintains a negative pressure within the structure relative to the outside atmosphere.

SECTION 2
HEALTH AND SAFETY ORGANIZATION AND ADMINISTRATION

The responsibilities of personnel involved in developing and implementing health and safety activities and procedures for EDS operations must be clearly defined for all involved organizations. Organizational responsibilities are shown in table 2-1.

Table 2-1. Safety Responsibilities

Title, Name, Phone	Responsibilities
PMNSCM, EDS System Manager	• HASP review and approval • HASP modification/deviation approval • Overall responsibility for site operation
CMA Risk Management Directorate	• HASP preparation • HASP review and concurrence • HASP modification/deviation concurrence • Conflict resolution • Reporting/recording accidents or injuries in accordance with Army and PMCD policies • Oversight • Pre-operational survey
DPG Chemical Agent Safety Specialist	• DPG safety oversight • HASP concurrence
Safety Engineer, ECBC	• Implementation of team Safety Program • HASP review and concurrence • HASP modification/deviation concurrence • Operations and maintenance procedures review • Periodic safety audits and inspections as required • Reporting/recording accidents or injuries in accordance with Army policies and to CMA-Risk Management Directorate
EDS Crew Chief, ECBC	• HASP review and concurrence • HASP modification/deviation concurrence • HASP implementation and enforcement • Accident prevention • Site safety training • Documentation/reporting • Notification • Site control
EDS Safety and Health Officer (SHO), ECBC	• HASP review and concurrence • HASP modification/deviation concurrence • HASP compliance confirmation • Documentation/reporting • Notification • Safety inspections and audits • Site safety training • Accident prevention • Coordinate with site monitoring personnel

Table 2-1. Safety Responsibilities (Continued)

Title, Name, Phone	Responsibilities
Operations Personnel (All)	• HASP adherence • Accident prevention • Notification

Notes:

CMA	=	U.S. Army Chemical Materials Agency
DPG	=	Dugway Proving Ground
ECBC	=	Edgewood Chemical Biological Center
EDS	=	Explosive Destruction System
HASP	=	Health and Safety Plan
PMCD	=	Program Manager for Chemical Demilitarizaiton
PMNSCM	=	Product Manager for Non-Stockpile Chemical Materiel

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SECTION 3
TASK SAFETY AND HEALTH RISK ANALYSIS

This section addresses the potential health and safety hazards that may be encountered during EDS operation. Specific descriptions of the tasks will be provided in the operations and maintenance (O&M) manual and the Standing Operating Procedures (SOPs) for EDS.

3.1 Chemical Hazards

3.1.1 Chemicals of Concern. Chemical hazards are associated with the following items:

a. The chemical warfare materiel (CWM) of concern for the EDS will be H and GB.

b. Treatment reagent will be 90 percent MEA for H.

c. Treatment reagent will be 45 percent MEA for GB.

d. The decontaminant for cleanup of spills is 5.25 percent sodium hypochlorite (household bleach).

e. The compressed gases and calibration standards used with the MINICAMS® are:

In compressed gas cylinders:

- Air (zero grade)
- Hydrogen

- Nitrogen
- Helium.

Compressed helium is also used during EDS operations to flush the containment vessel.

In working standards and calibration vials:

- Dilute H in isopropyl alcohol or hexane.
- Dilute GB in isopropyl alcohol or hexane.

f. A combination of linear-shaped and conical-shaped explosive charges will be used to breach the items being treated and destroy the energetics.

The linear-shaped charge (LSC) is a cyclonite (RDX)-based, copper LSC, and the conical-shaped charge (CSC) is a Composition A-3-based copper CSC.

The maximum net explosive weight for the EDS operations will not exceed the equivalent of 1 pound of TNT.

g. Miscellaneous chemicals used to support EDS activities or for routine or occasional maintenance of the EDS equipment are included in table 3-1.

The chemicals/substances expected to be used for EDS activities are identified in appendix B. Miscellaneous chemicals used to support EDS activities or for routine or occasional maintenance of the EDS are listed in table 3-1. Material Safety Data Sheets (MSDSs) for all chemicals will be maintained at the EDS site.

Table 3-1. Miscellaneous Chemicals Used to Support EDS

Material	Intended Use	Comment
PermaSlik®	Vessel sealing lubricant	Applied using spray gun and compressed air.
Ethyl Acetate (99.5+%)	Remove PermaSlik from spray gun nozzle	Applied using spray gun and compressed air then discharged into 5-gallon container (flushed through gun)
Hydra Oil, Wanner (EPMD-F/G 20W or Equivalent)	Lubricate supply pump	
Pneumatic Lubricating Oil	Lubricate air driven drum pump and double diaphragm air pump	
Acetic Acid (Vinegar)	Remove mineral deposit build-up in supply tanks and lines	Approximately 20 liters
Fluorolube Oil	Dampening the valve panel pressure gauge to eliminate erratic readings	
Fluorolube Grease	Lubricating the pressure gauge fittings	May be applied using a syringe
Helium Purity, Compressed, 99.99%	Vessel leak detecting and purge	
Mobil DTE 25 Hydraulic Oil	Hydraulic system and tensioner pump	
Detergent, General Purpose	General cleaning	
Grease, Multipurpose	Grease fittings and general areas not requiring specific grease	
Loctite®	Nut and bolts	
Oil, 10W30	Coleman Powermate Compressor	
Vacuum Grease, Dow Corning	Used to lubricate seals	
Vacuum Pump Fluid (oil)	Used for vacuum pump and leak detector	
WD 40 Aerosol	General purpose solvent	

3.1.2 Exposure Pathways. The following paragraphs describe the various exposure pathways through which contaminants can be introduced and the general precautions required to reduce the potential for human exposure. The EDS is designed to preclude exposure of personnel to hazardous chemicals. Site monitoring will determine what levels of airborne chemical concentrations personnel may be exposed to during operations. A combination of near real-time (NRT) monitoring (for chemical agent), real-time monitoring (for example, for carbon monoxide), and/or integrated sampling (for example, personal and area sampling for toxic industrial chemicals) will be used.

Piping from the waste collection drum filters will be plumbed to the VCS filtration system. The VCS filters are capable of exhausting 2,000 cubic feet per minute (cfm) of air volume to ensure adequate airflow within the VCS.

a. *Inhalation.* The inhalation of chemical vapors and mists is considered a significant means of potential exposure to the chemicals of concern. Workers will not routinely handle hazardous chemicals unless they are under engineering control or the workers are protected with respiratory protection. The potential for chemical exposure via inhalation will exist during spill situations and during sampling operations. The EDS explosion containment vessel, combined with site monitoring, is designed to prevent worker exposure above the time-weighted average (TWA) during routine operations.

b. *Dermal Contact.* Absorption through the skin from direct physical contact with chemical materiel is another potential means of exposure to the chemicals of concern involved in this project. Personal protective equipment (PPE) worn during loading, unloading, and sampling tasks is resistant to the types of chemicals being handled. NRT low-level monitoring will be conducted to demonstrate that items handled outside the exclusion zone are not leaking. The EDS, in conjunction with appropriate PPE use and monitoring systems, will be used to control exposure via the dermal route.

c. *Ingestion.* The potential for ingestion of contaminated media will be controlled through the use of good personal hygiene and by not allowing eating or drinking inside the exclusion zone or at the Contamination Reduction Area.

The identification of chemical hazards is summarized in table 3-2.

3.2 Physical Hazards

Physical hazards associated with the project tasks pose an equal or greater potential for injury at this site than chemical exposure. Physical hazards can be posed by:

- Motorized equipment
- Heavy objects
- Excessive noise
- Biological hazards (for example, insects, toxic plants, rodents)
- Heat stress (see appendix C)
- Cold stress (see appendix D)
- Tripping and falling hazards
- Thermal injuries
- Rotating machine parts
- Electrical shock

Table 3-2. Identification of Chemical Hazards

Process Stream/ Support Operation	Chemical Substances	Notation
Fill Materiel	Mustard (H) Sarin (GB)	Munitions to be treated in EDS have previously been assessed to determine fill materiel.
Bursters, Charges (LSC, CSC), and Munition Explosives	Tetryl, TNT (2,4,6-trinitrotoluene), RDX (cyclotrimethylene trinitramine), picric acid, ammonium chloride, mercury fulminate, black powder, ophorite	The shaped charges, munition bursters (if present), and the energetic material within the munitions may contain these explosives. The total weight of explosive material, per munition, is limited to 1 pound TNT equivalent or less.
	Metals (Al, Cu, Pb)	Bursters may contain one or more of these metals.
Chemical Treatment Reagents	Monoethanolamine (MEA) premixed with 10% water MEA premixed with 55% water	Provided in bulk drums or containers MEA used for H and GB
Air Monitoring/ Laboratory Support	He, Air, N_2	Compressed gases used for operation of MINICAMS® and DAAMS tube analysis
	HD, GB	Dilute agent for calibration, used with MINICAMS and DAAMS
Routine and Occasional Support and Maintenance Activities	Lubricants, solvents, cleaners, PermaSlik®, etc.	PermaSlik is applied using spray gun and compressed air. Other materials, solvents, etc., are used on an as-needed basis (see table 3-1).
Gaseous Emissions	Chemical fill materiel, explosives	High levels of chemical fill materiel will exist in containment vessel after munition is accessed; moderate levels of explosives may exist. After chemical treatment, low levels of airborne fill materiel may be present in vessel and in void above solid and liquid wastes.
	Decomposition/reaction products Process reagents	Small amounts of CO, NO_x, NH_3, and N_2 may be produced from deactivation of energetic materiel. Trace levels of some volatile organic compounds (VOCs) may be produced during charge detonation and/or may be present when the vessel door is opened.
	H_2	Used to purge the EDS vessel

Table 3-2. Identification of Chemical Hazards (Continued)

Process Stream/ Support Operation	Chemical Substances	Notation
Liquid Waste	MEA	The post-treatment liquid waste stream (H, GB) may contain significant amounts of MEA (up to 90%).
	Spent sodium hypochlorite in water (bleach)	Used to decontaminate spills
	Chemical fill materiel (H or GB)	Before release, the liquid waste will be verified analytically.
	Explosives (tetryl, TNT, RDX, etc.)	Although the treatment reagents are effective for explosives as well as the chemical fills, trace levels may remain.
	Metals (Al, Cu, others)	Low levels of dissolved or suspended metals may exist from bursters, the munition body, and the shaped charges.
	Inorganics (cyanide, nitrate, nitrite, sulfide)	Some nitrogen- and sulfur-containing inorganics may be expected from energetic deactivation reactions.
Solid Waste	Chemical fill materiel (H or GB)	Although thoroughly treated to destroy the materiel, trace levels may remain.
	Explosives (tetryl, TNT, RDX, etc.)	Although treatment reagents are also effective for explosives, trace levels may remain.
	Metals (Al, Cu, others)	Metal oxides are likely to be present as precipitates, as well as larger fragments of the munition body.
	Inorganics (cyanide, nitrate, nitrite, sulfide)	Some nitrogen- and sulfur-containing inorganics are likely to be present as precipitates formed from energetic deactivation reactions.

Notes:

CSC = conical-shaped charge
DAAMS = Depot Area Air Monitoring System
EDS = Explosive Destruction System
LSC = linear-shaped charge
MEA = monoethanolamine
RDX = cyclonite
TNT = trinitrotoluene

- Compressed gas cylinders including compressed air systems

- Fragmentation from explosion.

Injuries that may result from these physical hazards can range from slip-trip-fall types of accidents to casualties due to moving and/or rotating equipment. Injuries resulting from physical hazards can be avoided through the adoption of safe work practices and by employing caution when working with machinery.

To ensure a safe workplace, regular safety inspections are performed and documented. Safety inspections are conducted by the EDS System Manager, EDS Crew Chief, or EDS Safety and Health Officer (SHO), or other team members who have been trained and qualified for the inspection. The EDS System Manager and EDS Crew Chief will inform all site workers of any physical or chemical hazards related to each work zone. Daily health and safety briefings will be performed. The physical hazards and their preventive measures are discussed in the following paragraphs.

3.2.1 Motorized Equipment. Forklifts and trucks are among the types of motorized equipment that will be used onsite. This equipment can represent a hazard to workers. In general, requirements for motor vehicles and material handling equipment are provided in OSHA regulations (29 CFR 1910).

3.2.1.1 Specific Requirements. Specific requirements include the following:

a. Vehicles may not have cracked windshields or windows.

b. Forklift tines, dump bodies, and other hydraulic systems must be fully lowered when equipment is not in use.

c. Parking brakes must be engaged when equipment is not in use.

d. All lifting equipment must be inspected in accordance with U.S. Army Technical Bulletin 43-0142, *Safety Inspection and Testing of Lifting Devices*.

e. Motorized equipment should have an audible alarm that sounds when it is operating in reverse. Where there are no audible alarms on existing equipment, the operator must use the horn to signal the intention to back up.

f. All material handling equipment must have a rollover protection system or a hard stand unless operating on flat terrain or within a building.

g. Motorized equipment must be inspected by the operator prior to the beginning of each work shift. The EDS Crew Chief must ensure compliance to this regulation and ensure the inspection log is maintained.

3.2.1.2 General Requirements. General safety guidelines include the following:

a. Ensure gas cylinders are secured properly when they are moved or stored, and during use. Gas cylinders will be located in an area where they can be easily secured (chained or otherwise kept from tipping over) or kept in a bottle rack. Cylinders not in use will be kept capped. All cylinders will be tagged to indicate status (for example, "In use," "Full," or "Empty").

b. Wear hard hats, safety shoes, leather work gloves, and other protective equipment when specified by task-specific SOPs.

c. Establish hand-signal communication when verbal communication is difficult. Designate one person per work group to give hand signals to vehicle operators.

d. Only trained, certified, and licensed personnel are to operate motorized equipment. Training documentation will be kept at the command post.

e. Avoid walking directly in back of, or to the side of, motorized equipment without the operator's knowledge.

f. Ensure that no overhead power lines, telephone lines, or other utilities present a hazard in the work area. This requires marking and flagging all support wires for utility poles that are within the area used by a forklift or load-carrying vehicle.

3.2.2 Heavy Objects. Workers have mechanical equipment available to lift heavy objects. If the weight of an object exceeds that which can be safely lifted by two workers (174 lbs), a lifting device will be used per Military Standard (MIL STD)-1472. Lifting equipment will be inspected before use per Technical Bulletin (TB) 43-0142.

3.2.3 Excessive Noise. Workers are protected from exposure to excessive noise through equipment design, noise management, and PPE. Workers potentially exposed to high or steady state noise are enrolled in a hearing conservation program that complies with 29 CFR 1910.95 and Army Regulation (AR) 40-5, *Preventive Medicine.* Noise from the filter unit and the generator are above exposure limits and workers shall be protected from the hazard.

There is minimal potential for hazardous noise levels during the operation of the EDS. The detonation of up to 1.0 pound of explosive (TNT equivalent) takes place in the explosion containment vessel. The 3-inch thick walls of the containment vessel dampen the noise from the detonation limiting the impulse noise to a value less than 140 decibels (dB). Noise generated by the detonation is considered to be impact/impulse noise. Monitored sound pressure levels (noise) indicated that noise levels were below the OSHA action level of 85 dB(A)-weighted scale during previous EDS testing.

If electrical power is provided by generators, a noise hazard area will be prescribed around each generator and workers instructed about precautions to take. The generators will be installed in a location that will cause potentially hazardous noise exposure to the fewest workers. Personnel required to work within the hazardous noise area, for example the generator operator, will be enrolled in a hearing protection program and will be provided with suitable hearing protection.

3.2.4 Biological Hazards. No specific biological hazards are known to exist at the EDS site. However, it is possible that rodents or other indigenous animals as well as biting or stinging insects, spiders, and other arthropods may be encountered. Workers will be instructed to avoid contact with wildlife. If rodents, insects, or spiders should become a problem at the EDS site, the EDS System Manager will coordinate with DPG to implement appropriate control measures.

3.2.5 Heat Stress. Wearing PPE can increase the risk of a worker developing heat stress. Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and individual characteristics of the worker. Heat stress is one of the most common and potentially serious illnesses at hazardous sites. Regular monitoring and other precautions are vital.

Personnel working within the exclusion area when agent is present will be wearing Level C PPE. The area may be subject to heat build-up during treatment. The vessel is heated to temperatures between 50° to 100°C (122° to 212°F) using external heaters with a surface temperature of 400°F. The heaters are well insulated and the surface temperature of exposed vessel surfaces should not present a serious burn potential. Workers in these and similar levels of protection will be closely observed for heat stress.

The monitoring methods, symptoms, and preventive measures for heat stress are provided in appendix C.

Ambient temperature within the EDS work area will be monitored and workers will adhere to maximum wear times and protocol established by American Conference of

Governmental Industrial Hygienists (ACGIH), Threshold Limit Values (TLVs), and Biological Exposure Indices (BEIs), appendix C.

3.2.6 Cold Stress. If the body has a poor physiological response to cold weather work, a number of adverse health effects can occur. These may include hypothermia, frostbite, frostnip, and trench/immersion foot.

The monitoring methods, symptoms, and preventive measures for cold stress are provided in appendix D.

3.2.7 Tripping and Falling Hazards. Workers will be apprised of potential tripping hazards through the daily health and safety briefings conducted by the EDS System Manager, Crew Chief, and SHO. Whenever possible, trip and fall hazards have been eliminated or are clearly marked.

The work platform at the rear of the EDS Trailer is approximately 37 inches above the ground. Falling from this height could cause injury. A 5-foot safety rail surrounds the trailer working area.

3.2.8 Thermal Injuries. Thermal injuries can occur when excessively hot items are being handled. These items may include the vessel and tank heaters, and site monitoring system detectors. These items will be labeled "HOT."

3.2.9 Rotating Machine Parts. Pieces of mechanical equipment with rotating parts have guards to prevent contact and are not operated with guards removed. Watches, jewelry, and other loosely hanging articles must be removed prior to working around rotating machine parts.

The EDS vessel rotates via an electric gear drive. If the vessel were activated inadvertently, personnel could potentially have contact with rotating machine parts. This hazard is controlled by the EDS Crew Chief physically controlling the interlock key and ensuring that all personnel are clear (accounted for) of vessel prior to activating the

electric gear drive. Should personnel need to work on or near the vessel when it is rotating, an EDS Crew Chief or other trained EDS operator must accompany them. The trained EDS operator will stop rotation of the vessel and remove the interlock key.

3.2.10 Electrical Shock Hazards. All electrical wiring must be installed according to the National Electrical Code, and all electrical equipment must meet National Electrical Code standards. Electrical shock hazards may exist during equipment failure. All maintenance activities will be conducted following 29 CFR 1910.147 (The control of hazardous energy [lockout/tagout]).

3.2.11 Compressed Gas Cylinders. Compressed gas cylinders must be properly sorted, handled, transported, and labeled to clearly identify the gas contained. They also will have tags to indicate when cylinder is empty or "in use."

a. During storage, compressed gas cylinders must be protected from heat sources such as intense radiant heat, electric arcs, and high-temperature lines. The storage area must also protect the cylinders from passing or falling objects, as well as unauthorized tampering. Storage must also prevent the cylinders from tipping, falling, and rolling.

b. Workers must be sure to close off the valves before moving cylinders, at the end of each job, and when cylinders are empty. Valve protection caps must be placed on cylinders when they are not in use. The periodic check, conducted daily, should include a close inspection of the cylinder bottom.

c. During transportation, cylinders must be protected from tipping, falling, and rolling.

3.2.11.1 Compressed Air Systems. Compressed air systems must be operated according to manufacturer's specifications regarding maximum allowable pressure for

the application. Equipment must have a pressure rating. Operators must monitor the system such that the operating pressure is not exceeded.

Air guns that use compressed air for cleaning must be pressure-reduced down to a maximum of 30 pounds per square inch (psi) for use during EDS operations.

3.2.11.2 Breathing Air. Breathing air used to support EDS operations will be Grade D. Breathing air will be certified to meet the criteria defined by the American National Standards Institute/Compressed Gas Association (ANSI/CGA) standards G-7, Compressed Air for Human Respiration, and G-7.1, Commodity Specification for Air.

3.2.12 Fragmentation from Explosion. It is possible that a munition could detonate if dropped while it is being prepared for placement into the EDS. Fragments from that explosion could cause injury or death of nearby workers. Only Explosive Ordnance Disposal trained personnel will handle munitions and explosives. An explosive hazard area has been identified and non-essential personnel will be excluded from that area when munitions or explosives are being handled.

3.3 Work Areas

The EDS site should have a clearly marked boundary for the exclusion area. Signs identifying the work site must be placed at the main access points. Use of PPE within this area is in accordance with this HASP and installation policies if applicable.

3.3.1 Designation of Work Zones. The work areas should be clearly demarcated into three zones:

a. *Exclusion Zone.* The exclusion zone encompasses the area that might become contaminated, should a spill or leak occur. This includes the area that falls within the footprint of the VCS.

b. *Contamination Reduction Zone (CRZ).* The CRZ acts as a buffer in which decontamination of personnel will be performed, should a spill or leak occur. The Personnel Decontamination Station (PDS) is within the CRZ.

c. *Support Zone.* The Support Zone includes all areas outside the VCS and PDS. These are areas where nonagent support activities take place.

The work zones are designated according to potential for contamination and activities normally conducted in that area. All workers must process into and out of the exclusion zone through the PDS. (Figure 3-1 depicts the location of the zones.)

3.3.2 Control at the Site. In order to minimize the potential spread of contaminated material from the exclusion zone to clean areas due to site activities, and to reduce the possibility of exposure to personnel in clean areas, control procedures will be implemented at the site. The EDS System Manager or a designated representative will control access to the work site (including the support area, CRZ, and the exclusion zone). Warning signs will be placed at the entrance to the CRZ stating "Authorized Personnel Only," and the PDS operator will control access to the CRZ and exclusion zone should an emergency situation occur. Site access will be documented on a daily log.

3.4 Hazard Assessment

Table 3-3 contains summary exposure assessments, hazard assessments, and control measures for each potential exposure pathway for each chemical or class of chemicals.

The ingestion pathway is assumed to present a slight risk and is not assessed further. The consideration of the inhalation and dermal exposure routes is deemed sufficient for this assessment.

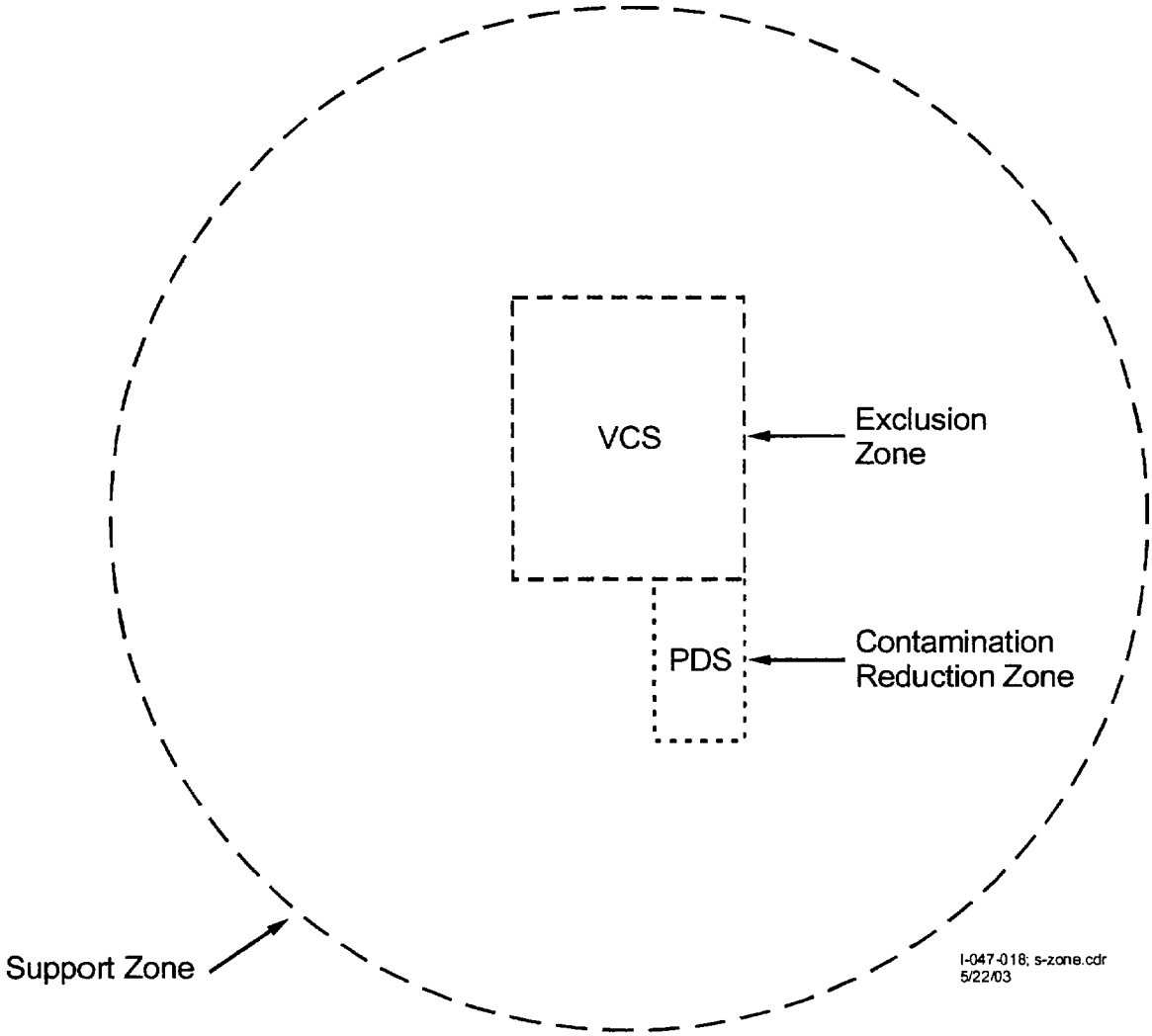

Figure 3-1. EDS Work Zones

Table 3-3. Assessment of Hazards

Operation	Chemical Substance(s)	Exposure Assessment	Hazard Assessment	Control Measures
Handling Munitions	Chemical agent fills (H and GB)	Dermal – Exposure may occur if munition is leaking or is mishandled.	Dermal – Skin contact with some agents may cause severe injury.	SOP; personal protective equipment – See table 5-1 in this document.
		Inhalation – Exposure may occur if munition is leaking or is mishandled.	Inhalation – Exposure to some airborne agents may cause death even after short exposure.	Engineering Control – filter/mechanical ventilation; 0 SOP; personal protective equipment – See table 5-1 in this document.
	Explosive compounds (RDX or Comp A3, TNT, tetryl, black powder)	Dermal – Exposure may occur if munitions explosive compounds are directly contacted.	Dermal – Negligible hazard due to short contact period	Administrative – Minimize handling time.
		Inhalation – Limited exposure may occur if munitions explosive compounds are directly contacted.	Inhalation – Negligible hazard due to short exposure period and relatively low airborne levels anticipated	Administrative – Minimize handling time.
Sampling Containment Vessel Vapors	Chemical agents (H and GB)	Dermal – Although vapor sample is drawn remotely, skin exposure to small amount of vapor or condensate may occur when retrieving sample bottle.	Dermal – Minor bodily injury is possible if certain agents (blister agents and those that are severe irritants) contact the skin, even at low quantities.	SOP; personal protective equipment – See table 5-1 in this document.
		Inhalation – Low-level exposure may occur due to leakage of the sample bottle seals or leakage of other vessel seals into the work area.	Inhalation – Although safeguards (air monitoring, personal protective equipment, engineering design, etc.) are in place to prevent personnel exposure to elevated levels (above worker exposure limits) of airborne agents, it is assumed that exposure to low levels may cause minor bodily injury.	Engineering Control – filter/mechanical ventilation; SOP; personal protective equipment – See table 5-1 in this document.

Table 3-3. Assessment of Hazards (Continued)

Operation	Chemical Substance(s)	Exposure Assessment	Hazard Assessment	Control Measures
Sampling Containment Vessel Vapors (continued)	Explosives (RDX or Comp A3)	Dermal – Skin exposure to very small quantities may occur when retrieving sample.	Dermal – Hazard expected to be negligible due to short exposure time and very small quantities expected	SOP; personal protective equipment – See table 5-1 in this document.
		Inhalation – Very low-level exposure may occur due to leakage of sample bottle seals or leakage of other vessel seals.	Inhalation – Hazard expected to be negligible due to limited exposure time and very low level of airborne contaminants expected	Engineering control – filter/mechanical ventilation; SOP; personal protective equipment – See table 5-1 in this document.
	Decomposition products from explosion (ammonia, nitrogen oxide, nitrogen, VOCs)	Dermal – Exposure to extremely small quantities may occur.	Dermal – No hazard due to limited exposure period and lack of toxicity of products via skin contact/absorption	SOP; personal protective equipment – See table 5-1 in this document.
		Inhalation – Very low-level exposure may occur due to leakage of sample bottle seals or leakage of other vessel seals.	Inhalation – Hazard expected to be negligible due to limited exposure time and very low level of airborne contaminants expected	Engineering control – filter/mechanical ventilation; SOP; personal protective equipment – See table 5-1 in this document.
Reagent Transfer Operations	Reagents (MEA, solvents, etc.)	Dermal – Limited exposure may be expected to occur frequently, and significant exposure may occur at some point in operations.	Dermal – As strong skin and eye irritants, severe injury may occur with significant exposure.	SOP; personal protective equipment – See table 5-1 in this document.
		Inhalation – Limited exposure will occur frequently, and significant exposure may occur at some point in operations.	Inhalation – As respiratory irritants, short-term exposure may cause minor injury.	Engineering control – filter/mechanical ventilation; SOP; personal protective equipment – See table 5-1 in this document.

Table 3-3. Assessment of Hazards (Continued)

Operation	Chemical Substance(s)	Exposure Assessment	Hazard Assessment	Control Measures
Sealing EDS Vessel	Sealants/ degreasers (Perma-Slik®)	Dermal – Exposure to extremely small quantities may occur.	Dermal – No hazard due to limited exposure period and low-order toxicity on the unprotected skin	Administrative – minimize sealing time
		Inhalation – Exposure may occur.	Inhalation – Short-term exposure may cause minor injury.	Engineering control – filter/mechanical ventilation; SOP; personal protective equipment – See table 5-1 in this document.
Sampling Liquid Treatment Waste and Handling Liquid Waste Drums	Treatment reagent (MEA)	Dermal – Limited exposure may be expected to occur frequently, and significant exposure may occur at some point in operations.	Dermal – As strong skin and eye irritants, severe injury may occur with significant exposure.	SOP; personal protective equipment – See table 5-1 in this document.
		Inhalation – Limited exposure will occur frequently, and significant exposure may occur at some point in operations.	Inhalation – As respiratory irritants, short-term exposure may cause minor injury.	Engineering control – filter/mechanical ventilation; SOP; personal protective equipment – See table 5-1 in this document.
	Chemical fill materiel (H and GB)	Dermal – Limited exposure expected to occur frequently, and significant exposure may occur at some point in operations.	Dermal – Hazard is negligible since presence of agent will be verified prior to transferring to waste drum.	Administrative – minimize sampling time; personal protective equipment – See table 5-1 in this document.
		Inhalation – Limited exposure expected to occur frequently, and significant exposure may occur at some point in operations.	Inhalation – Hazard is negligible since presence of agent will be verified prior to transferring to waste drum.	Administrative – minimize sampling time; personal protective equipment – See table 5-1 in this document.

Table 3-3. Assessment of Hazards (Continued)

Operation	Chemical Substance(s)	Exposure Assessment	Hazard Assessment	Control Measures
Sampling Liquid Treatment Waste and Handling Liquid Waste Drums (continued)	Explosives (RDX and Comp A3)	Dermal – Limited exposure expected to occur frequently, and significant exposure may occur at some point in operations.	Dermal – Hazard is negligible due to short exposure period and low levels anticipated in solution.	Administrative – minimize sampling time
		Inhalation – No exposure anticipated	Inhalation – No hazard	
	Metals (aluminum, copper, others)	Dermal – Limited exposure expected to occur frequently, and significant exposure may occur at some point in operations.	Dermal – Hazard is negligible due to short exposure period and low levels anticipated in solution.	Administrative – minimize sampling time
		Inhalation – No exposure anticipated	Inhalation – No hazard	
	Inorganics (cyanide, nitrate, nitrite, sulfide)	Dermal – Limited exposure expected to occur frequently, and significant exposure may occur at some point in operations.	Dermal – Hazard is negligible due to short exposure period and low levels anticipated in solution.	Administrative – minimize sampling time
		Inhalation – No exposure anticipated	Inhalation – No hazard	
Sampling Solid Waste and Removal from Containment Vessel	Chemical fill materiel (H and GB)	Dermal – Limited exposure expected to occur frequently	Dermal – Hazard is negligible due to short exposure period and low levels anticipated to be remaining in waste.	SOP; personal protective equipment – See table 5-1 in this document.
		Inhalation – Limited exposure expected to occur frequently	Inhalation – Hazard is negligible since presence of agent will be verified prior to transferring to waste drum.	Engineering control – filter/mechanical ventilation; SOP; personal protective equipment – See table 5-1 in this document.

Table 3-3. Assessment of Hazards (Continued)

Operation	Chemical Substance(s)	Exposure Assessment	Hazard Assessment	Control Measures
Sampling Solid Waste and Removal from Containment Vessel (continued)	Explosives (RDX and Comp A3)	Dermal – Limited exposure expected to occur frequently	Dermal – Hazard is negligible due to short exposure period and very low levels anticipated to be remaining in waste.	Administrative – minimize sampling time
		Inhalation – No exposure anticipated	Inhalation – No hazard	
	Metals (aluminum, copper, others)	Dermal – Limited exposure expected to occur frequently	Dermal – Hazard is negligible due to short exposure period and low levels anticipated in waste.	Administrative – minimize sampling time
		Inhalation – No exposure anticipated	Inhalation – No hazard	
	Inorganics (cyanide, nitrate, nitrite, sulfide)	Dermal – Limited exposure expected to occur frequently	Dermal – Hazard is negligible due to short exposure period and low levels anticipated in waste.	Administrative – minimize sampling time
		Inhalation – No exposure anticipated	Inhalation – No hazard	
Monitoring Support Operations	Compressed gases for MINICAMS® (or other equivalent instrumentation) operation (hydrogen, air, nitrogen, helium)	Dermal – Possible exposure to high-pressure leak from line	Dermal – Hazard is negligible since gases are not toxic via skin contact/absorption and leak would not have enough force to cut skin.	SOP; personal protective equipment – See table 5-1 in this document.
		Inhalation – Exposure to leak likely to occur at some point in operations	Inhalation – Negligible hazard since gases are non-toxic and are not expected to cause IDLH atmospheres in ventilated room.	Engineering control – filter/mechanical ventilation; SOP; personal protective equipment – See table 5-1 in this document.

Table 3-3. Assessment of Hazards (Continued)

Operation	Chemical Substance(s)	Exposure Assessment	Hazard Assessment	Control Measures
Monitoring Support Operations (continued)	Calibration standards in compressed gas	Dermal – Possible exposure due to leak in line or cylinder	Dermal – Negligible hazard since standards contain insufficient quantities of gaseous agents to present a dermal hazard.	SOP; personal protective equipment – See table 5-1 in this document.
		Inhalation – Exposure to leak likely to occur	Inhalation – Minor injury may result due to exposure to relatively low levels of airborne agent released from calibration cylinder.	SOP; personal protective equipment – See table 5-1 in this document.
	Calibration standards in solution	Dermal – Likely to occur	Dermal – Minor injury may result due to exposure to dilute agent quantities or limited contact time.	SOP; personal protective equipment – See table 5-1 in this document.
		Inhalation – Exposure is unlikely	Inhalation – No hazard	
Routine and Occasional Support and Maintenance Activities	Lubricants, solvents, cleaners, etc. (See table 3-2 for complete list.)	Dermal – Exposure to extremely small quantities may occur.	Dermal – Minor injury (dermatitis) may occur.	SOP; personal protective equipment – See table 5-1 in this document.
		Inhalation – Exposure may occur.	Inhalation – As respiratory irritants, short-term exposure may cause minor injury.	Engineering control – filter/mechanical ventilation; SOP; personal protective equipment – See table 5-1 in this document.

Notes:

EDS = Explosive Destruction System
H = mustard
IDLH = immediately dangerous to life and health
MEA = monoethanolamine
RDX = cyclonite
SOP = Standing Operating Procedure
TNT = trinitrotoluene
VOC = volatile organic compound

SECTION 4
AIR MONITORING

The EDS will be deployed at the site inside a VCS and air monitoring for worker safety will be performed. Edgewood Chemical Biological Center (ECBC) will be the lead agency with responsibility for air monitoring. Monitoring for worker safety will be performed for chemical agents (H and GB) using MINICAMS. In addition, carbon monoxide will be monitored inside the VCS.

The Site-Specific Monitoring Plan (annex F to the Destruction Plan) contains details of the monitoring activities at the EDS site. Chemical agent air monitoring will be conducted using the low-level NRT MINICAMS. Confirmation monitoring will be performed with Depot Area Air Monitoring System (DAAMS) tubes for H and GB. Perimeter monitoring will be performed using DAAMS tubes.

The workplace exposure limit for H is 0.003 milligram per cubic meter (mg/m^3) and 0.0001 mg/m^3 for GB. NRT monitoring will take place at several locations within the VCS and the VCS air filtration system. Confirmation monitoring for H and GB using DAAMS tubes will be possible at any location where a NRT monitor is located. Monitoring locations in the VCS include the entry/exit door, the unpack area, above the EDS vessel door, and above the waste drums. Two monitoring locations will be established for general area monitoring based on airflow patterns measured after equipment setup. Within the air filtration system monitoring ports will be located in the midbed space of the carbon filter and at a point down stream from the last filter element. In the PDS, monitoring capability will be available to ensure personnel are not contaminated when they exit the facility.

The Monitor Operator will notify the EDS System Manager and EDS Crew Chief of any detections of chemical agent above alarm levels. In general, since workers inside the VCS will be in OSHA Level C PPE, they will evacuate the VCS if chemical agent is detected above alarm levels. Workers wearing OSHA Level A PPE will reenter the VCS

to identify the source of the agent, and take steps to eliminate the source and decontaminate as necessary before resuming normal operations.

If chemical agent is detected outside of engineering controls (outside of the VCS) the EDS System Manager will notify the DPG Emergency Operations Center (EOC) and implement response procedures as directed. The EDS System Manager/SHO will notify the PMNSCM and ECBC of release as soon as possible after steps to protect the workforce and public have been implemented.

SECTION 5
PERSONAL PROTECTIVE EQUIPMENT

PPE will be worn by all personnel working within the EDS exclusion zone and PDS. PPE is designed to protect workers from known or suspected vapor, solid, and liquid contamination. The PPE levels for individual work tasks are specified in SOPs and have been selected based upon the anticipated concentrations of contaminants that may be encountered, their chemical properties, toxicity, exposure routes, and contaminant matrix. Table 5-1 of this HASP contains a summary of OSHA PPE levels to be worn during various tasks. Appendix E to this HASP describes the PPE in greater detail.

Visitors authorized by the EDS System Manager to enter the operations area will be required to wear the PPE equivalent to that worn by workers in the areas they will visit and are subject to relevant Army and OSHA requirements, such as training and medical surveillance.

5.1 PPE Deviation/Modification

Protection levels may be downgraded or modified on approval from the EDS System Manager. The EDS System Manager/SHO will initiate requests for downgrade/modification and obtain the concurrence of the U.S. Army Chemical Materials Agency (CMA) Risk Management Directorate (RMD) before implementing the change.

The following site-specific, safety-related factors may require upgrading, downgrading, or modification of PPE levels or wear policy:

- Worker experiences symptoms related to chemical exposure or heat stress

1 Table 5-1. PPE Levels[a]

2

Task	PPE Requirement[b]
Emergency Operations/Response	Level B • SCBA/SAR Respiratory Protection • Toxicological Agent Protective Ensemble Self-Contained or Trellborg • Chemical protective undergarments[c] • Butyl rubber boots
Process Equipment Setup	Level D • Long-sleeved shirts and trousers • Leather gloves • Steel-toed boots/shoes • Safety glasses
Handling Munitions/Chemical Filled Cylinders Upon Initial Receipt and Assessment	Level C • M40-series mask • Hood • M2A1 butyl rubber boots with safety toe or equivalent • Butyl rubber gloves (M3, M4, or gloveset) or equivalent • Chemical protective undergarments[c] • Butyl rubber apron or equivalent
Sampling Liquids/Vapors and Sampling Liquid Treatment Waste	Level C • M40-series mask • Hood • M2A1 butyl rubber boots with safety toe or equivalent • Butyl rubber gloves (M3, M4, or gloveset) or equivalent • Chemical protective undergarments[c] • Butyl rubber apron or equivalent
Handling Cleared Liquid Waste Drums	Level D • Long-sleeved shirts and trousers • Leather gloves • Steel-toed boots/shoes • Safety glasses • Butyl rubber apron or equivalent
Sampling Solid Waste and Removal of Munition/FSS Carcass	Level C • M40-series mask • Hood • M2A1 butyl rubber boots with safety toe or equivalent • Butyl rubber gloves (M3, M4, or gloveset) or equivalent • Chemical protective undergarments[c] • Butyl rubber apron or equivalent

Table 5-1. PPE Levels[a] (Continued)

Task	PPE Requirement[b]
Air Monitoring	Level D • Slung Mask (M40-series) • Long-sleeved shirts and trousers • Gloves • Steel-toed boots/shoes • Safety glasses
Routine and Occasional Maintenance	Level D • Slung Mask (M40-series) • Long-sleeved shirts and trousers • Gloves • Steel-toed boots/shoes • Safety glasses
Site Operations Support Personnel Data Collection Project Observers	Level D • Slung Mask (M40-series) • Long-sleeved shirts and trousers • Gloves • Steel-toed boots/shoes • Safety glasses
DAAMS Technicians (when collecting DAAMS tubes and chemical agents are present in the VCS)	Level C • M40-series mask • Hood • M2A1 butyl rubber boots with safety toe or equivalent • Butyl rubber gloves (M3, M4, or gloveset) or equivalent • Chemical protective undergarments[a] • Butyl rubber apron or equivalent
DAAMS Technicians (when installing/collecting DAAMS tubes and no chemical agents are present in the VCS)	Level D • Slung Mask (M40-series) • Long-sleeved shirts and trousers • Gloves • Steel-toed boots/shoes • Safety glasses
Decontamination Personnel	Level C • M40-series mask • Hood • M2A1 butyl rubber boots with safety toe or equivalent • Butyl rubber gloves (M3, M4, or gloveset) or equivalent • Butyl rubber apron or equivalent

Table 5-1. PPE Levels[a] (Continued)

Notes:

[a] Protection levels may be downgraded or modified on approval from the EDS System Manager.
[b] Level C is recommended when air monitoring has confirmed that chemical vapor concentration within the EDS work area does not exceed allowable exposure limits of 1.0 TWA. If chemical agent vapor concentrations are unknown or cannot be confirmed as not exceeding allowable exposure limits, then Level B must be donned.
[c] Chemical protective undergarments will be worn for mustard operations only.

DAAMS	=	Depot Area Air Monitoring System
FSS	=	Fragment Suppression System
PPE	=	personal protective equipment
SCBA/SAR	=	self-contained breathing apparatus/supplied air respirator
VCS	=	Vapor Containment System

- Change in EDS work tasks
- Change of season/weather
- Use of chemicals for maintenance other than those identified in section 3 of this HASP
- Change in work environment that affects the degree of exposure to contaminants.

5.2 Limitations of PPE

PPE ensembles have been selected to provide protection against expected contaminants at known or anticipated concentrations. However, no protective garment, glove, or boot is chemical-proof, or affords protection against all types of chemicals. Permeation of a chemical through PPE is a complex process governed by contaminant concentrations, environmental conditions, physical condition of the protective garment, and the resistance of a garment to a specific contaminant. Chemical permeation may continue even after the source of contamination has been removed from the garment.

In order to obtain optimal performance of PPE, the following procedures are to be followed by all site personnel using PPE:

a. Each organization will issue PPE to its personnel based on the requirements of the Destruction Plan, task-specific SOPs, and agency policies.

b. Disposable protective clothing will be inspected before, during, and after use for imperfect seams, non-uniform coatings, tears, poorly functioning closures and any other observable defects in material or manufacture.

c. Reusable protective clothing must be tagged with a valid inspection date at the time of issue. Wearers will inspect their garments before and during use for visible signs of chemical permeation, swelling, discoloration, stiffness, brittleness, cracks, any sign of puncture, and any sign of abrasion. (*Note: Garment must have valid inspection date on tag prior to donning.)*

Commercial gloves, boots, or coveralls exhibiting any of the characteristics listed above will be discarded. Military equipment exhibiting any of these symptoms will not be used and will be returned to the clothing issue point.

Any non-disposable PPE that has been contaminated with blood must be separated from normally laundered PPE. This is to protect laundry workers from blood-borne pathogen exposure. PPE that is contaminated with blood will be placed in appropriate containers that are labeled as BIOHAZARD per OSHA 1910.1030 (g)(1) and disposed of in accordance with all Federal, State, and local regulations.

5.3 Donning PPE

Work uniforms/PPE will be donned in the support zone before entering the CRZ. The EDS Crew Chief will ensure that PPE is properly donned before workers perform tasks requiring it. Workers will don hearing protection before entering areas requiring it.

Workers with minor injuries to the skin surface, such as cuts and scratches, will be given special attention before donning PPE in order to protect the injured areas. Such minor injuries potentially enhance exposure effects. Workers with large cuts, rashes, or other such skin damage will not be allowed to don PPE. The EDS System Manager or SHO, in consultation with occupational health personnel, will determine when an employee may not be able to wear PPE or perform other duties.

After donning the PPE, proper fit will be evaluated by the EDS Crew Chief/SHO or another qualified person before the worker is allowed to enter the CRZ or exclusion zone.

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SECTION 6
RESPIRATORY PROTECTION

6.1 Supplied-Air Respirators (SARs) and Self-Contained Breathing Apparatuses (SCBAs)

Personnel responding to situations involving unknown concentrations of hazardous chemicals will use a SCBA or a SAR with escape bottle.

Breathing air must meet the specification for grade D breathing air described in the CGA Specification G-7.1-1989 and in accordance with 29 CFR 1910.134. Vendors who supply breathing air will be required to certify the air meets the grade D breathing air specification. Quality verification may be based on production qualification tests or lot acceptance tests as agreed upon by supplier and EDS operator.

6.1.1 Escape Breathing Apparatus (EBA). Commercial EBAs will be used. These EBAs will be National Institute for Occupational Safety and Health (NIOSH)-approved. Units will use a 10-minute (or greater rating) cylinder and airline system.

6.1.2 SAR. In the event of an emergency, EDS operators will be supplied air from a cascade fed cluster system. The cascade trailer is located outside and adjacent to the VCS. The air lines are routed through the wall of the VCS where they are secured to the interior wall until needed. The air lines inside the VCS are capped with a closed quick-connect that prevents back flow.

6.1.3 SCBA. Commercial positive-pressure demand SCBAs will be used. These SCBAs will be NIOSH-approved. Units will be used with 60-minute rated cylinders. If a cascade bottle system is used to supply air to the operators, an escape SCBA will be worn.

6.2 Air-Purifying Respirators (APRs)

6.2.1 Escape Mask. Military-issue, M40 masks will be used for both emergency escape and normal operations by ECBC, U.S. Army Technical Escort Unit (TEU), and contractors. The M40 is a full-face APR with a chemical cartridge used for the military-unique chemical H. M40 masks will be issued from the APG Mask Issue or the DPG Masking Office.

6.2.2 Cartridge Change Frequency. The APR cartridges will be changed every 6 months or whenever there has been a confirmed exposure because of a spill or other type of process upset. The M40 masks will be turned in to the mask issue point in accordance with Army policies if they have been used for an emergency escape or on a periodic basis as scheduled.

6.2.3 APR Limitations. APRs are not to be used in situations where atmospheric contaminant concentrations are unknown, when oxygen levels are below 19.5 percent or above 23.0 percent, or concentrations of contaminants are immediately dangerous to life and health (IDLH).

6.3 Fit-Testing for APRs

M40 masks will be fit-tested by personnel assigned to the issue point. The test will be quantitative for the M40 mask. Personnel trained in fitting military masks perform all fit-testing. A fit-test record will be maintained at the mask issue point. Commercial masks will be fit-tested either at the issue point or at the EDS operations site by qualified personnel. The fit-test record will include the name and signature of the person wearing the respirator and the person supervising the test and the location, date and time of the test, details of respirator type, and test(s) performed.

When donning the mask, wearers will perform a positive- and negative-pressure fit-check when clearing and checking the mask. Workers are trained annually in donning, clearing, and checking masks.

6.4 General Safety for Respirator Use

The following general safety guidelines for respirator use will be adhered to during EDS activities.

6.4.1 Inspection and Cleaning. In addition to the inspection and testing done by the issue point, the APRs will be checked periodically by the EDS Crew Chief/SHO and the person issued the mask. Masks will be assigned to specific individuals at the mask issue point. If masks need to be worn by more than one person, the masks will be decontaminated and hygienically cleaned before being issued. Personnel required to wear SARs will be trained and certified to use them. Inspections of these respirators will be recorded. If liquid agent contaminates the face mask and/or air hose, it will be replaced.

6.4.2 Respirator Restrictions. The following respirator restrictions will be strictly adhered to during all field activities:

a. *Facial Hair.* Personnel with facial hair, such as a beard or a mustache that may interfere with the respirator seal, will not be permitted to wear the respirator, and hence, not be permitted to work at the site.

b. *Corrective Lenses.* Normal eyeglasses cannot be worn under full-face respirators because temple bars interfere with the respirator sealing surfaces. Workers requiring corrective lenses will be provided with spectacle inserts designed for use with the type of respirator that will be worn.

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SECTION 7
DECONTAMINATION

Decontamination is the process of removing or treating contaminants from personnel or equipment. When performed correctly, decontamination protects the worker from contaminants that may have come in contact with PPE, tools, and other equipment and also serves as the principal means of preventing the transport of potentially harmful materials into uncontrolled areas.

To prevent transfer of contaminated material to "clean" areas, equipment removed from the EDS exclusion zone will be monitored, decontaminated if required, and checked for completeness before being removed from engineering controls.

Personnel decontamination will be performed in the PDS according to the following procedures.

7.1 Personnel Decontamination

Routine exposure of personnel to hazardous material is not expected as part of this operation, but as a precaution, all workers will process through full-body showers and change trailer adjacent to the EDS site, before departing the site at the end of the day.

When an operator working in impermeable PPE has potentially been exposed to liquid agent, reagents, or other contaminated materials or when directed to by the EDS System Manager in coordination with the SHO, he or she will process through the PDS.

Should a spill occur, personnel will be decontaminated at the EDS PDS located within the CRZ (see figure 7-1). Personnel processed through the PDS will then immediately proceed to the shower trailer for a full-body shower before donning clean coveralls or

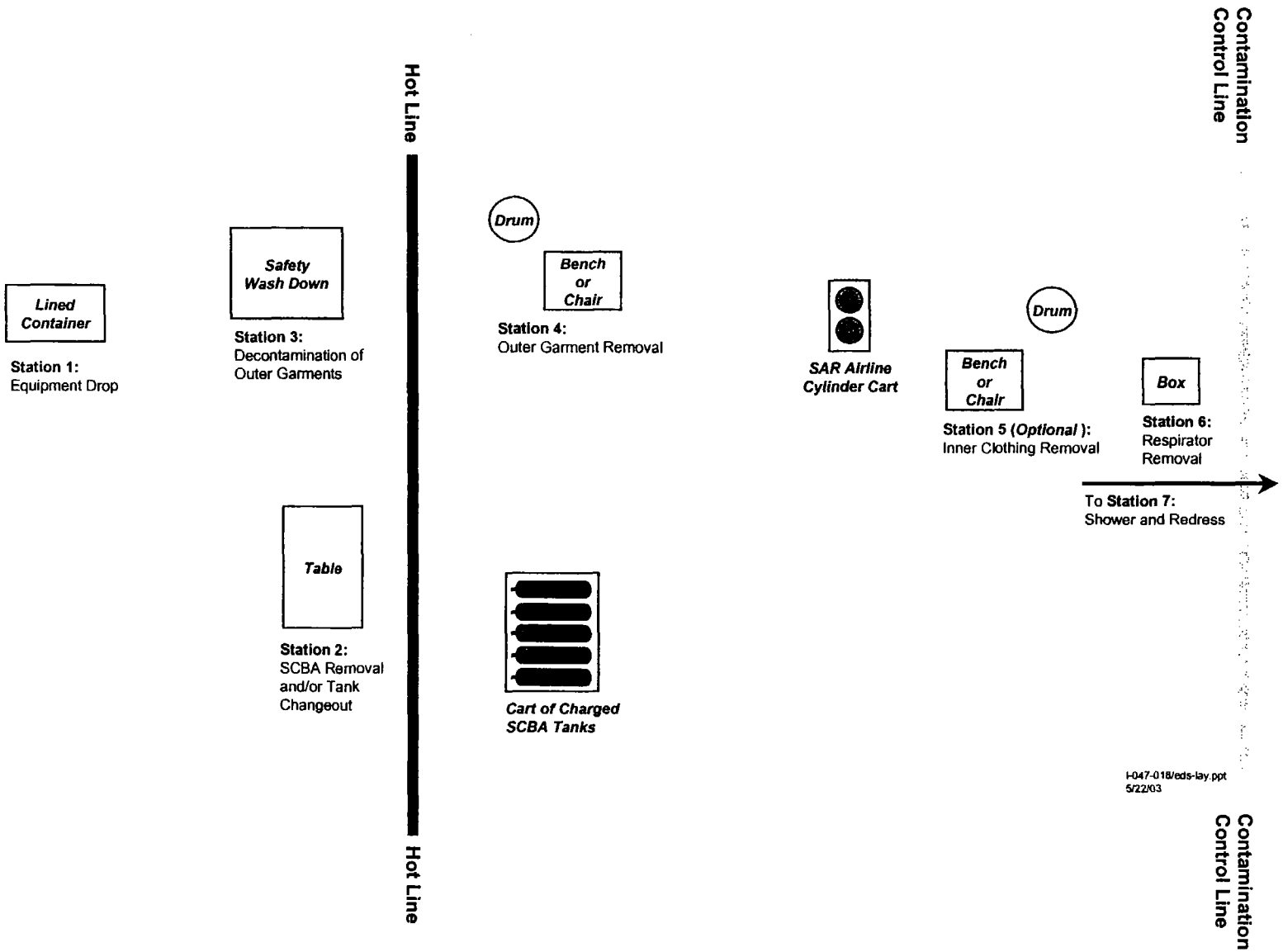

Figure 7-1. Typical PDS Layout

personal clothing. Any equipment contaminated because of a spill will be decontaminated before leaving the exclusion zone. Should anyone, including visitors and observers, become contaminated, the individual will be decontaminated at the PDS. Site access procedures, including the exclusion zone entry log will aid in determining personnel accountability with regard to decontamination procedures.

7.2 PDS

The PDS is connected to the VCS at the personnel entry/exit door. The PDS station will provide rapid and efficient egress from the exclusion zone while preventing the spread of contaminants. All EDS personnel are trained in and thoroughly familiar with decontamination and egress procedures.

All personnel leaving the VCS will process through the PDS. If there were no chemical agent alarms while the workers were in the VCS and no other reason to suspect they have been in contact with contamination, decontamination will be limited to cleaning boots and gloves. If workers have been in contact with contamination (for example, a munition leaking a liquid coincidental to a monitoring alarm), the workers will do full decontamination in the PDS according to the following procedures. The PDS will be staffed with attendants who will replenish supplies and assist workers processing through the PDS. PDS attendants will wear Level C PPE with splash protection.

STEP 1. *Equipment Drop.* Equipment used in the VCS will be placed on an area clearly identified as the "equipment drop."

a. *Equipment.* The Equipment Drop will consist of plastic sheeting (approximately 8 feet by 8 feet) or lined containers (drums, boxes, etc.) for temporary holding of potentially contaminated equipment.

b. *Action.* Place loose, hand-held tools and equipment in the equipment drop area.

STEP 2. *SCBA Tank Removal/Tank Exchange.* Non-routine operations may require the use of SCBAs. Personnel using SCBA will come to this station to exchange tanks or to remove their tanks and backpacks and be placed on an airline to process through the PDS to go to the support area. During tank exchange or transfer to airline, breathing protection will be maintained using the auxiliary air bottle. Workers wearing SARs will skip this step.

a. *Equipment.* Airline SAR (cascade system) with low-pressure alarm and air hoses (as required), decontamination solution (generally soapy water), sponges or rags, plastic-covered table, large plastic bags, small plastic bags, wheeled cart, fully-charged SCBA tanks, and tape or zip-ties

b. *Action.* Worker wearing SCBA moves to the "hot line." Attendant uses a sponge or a rag that is damp with decontamination solution to wipe the hose connection to remove any contamination. The attendant then connects the SAR airline to the hose on the SCBA, assists with the removal of the SCBA regulator assembly, places the regulator assembly in a plastic bag, and seals it with tape or zip-tie. The attendant assists with removal of the SCBA tank and backpack assembly and places both in a second plastic bag and seals that bag with tape or zip-tie.

STEP 3. *Decontamination of Outer Garments.* Workers exposed (confirmed or suspected) to liquid chemical agent (for example handling a leaking munition in combination with an air monitoring alarm) will decontaminate their outer garments as they process through the PDS. Other individuals will only clean their gloves and boots.

a. *Equipment.* Shower, soap/detergent, emergency medical technician (EMT) shears, sump pump, plastic sheeting, absorbent pads, one long-handled scrub brush (minimum), one bucket (minimum), and a drum

or similar container with tightly or self-closing lid for collection of waste water

b. *Action.* Individual will stand in shower while an attendant applies soapy water using a long-handled brush. After soap has been applied over all outer garments, the attendant will brush the outer garments from top down using downward strokes. After brushing, the outer garments will be rinsed with clean water. If the person being decontaminated is wearing permeable outer clothing (for example a Saratoga suit or cotton coveralls), wash and remove as directed by the PDS attendant. Persons wearing impermeable outer garments will leave the outer garments on while in the decontamination shower. When directed, the worker will step carefully out of the shower onto an absorbent pad. Decontamination will be verified by monitoring for agent on the individual. If agent is detected, the affected area will be identified and decontaminated again. After all workers have cleared this station, water collected in the shower sump will be pumped into a drum or similar container for sampling and subsequent disposal.

STEP 4. *Outer Garment Removal.* Attendant will assist individual with the removal of outer garments (suits, boots, gloves, etc.).

a. *Equipment.* Drum or similar container with tightly or self-closing lids (Note: the same container may be used to collect PPE from all stations, if appropriate), plastic-covered bench or chair, EMT shears, boot jack (if available), lined container for reusable garments, moisture-resistant booties, rubber mat, and absorbent pads

b. *Action.* PDS attendant will assist individuals with the removal of outer garments (suits, boots, gloves, etc.) and place garments in proper container. Garments will be removed from the head downward in such a way as to avoid exposing the individual to the outside of the garments. Once the garments are below the waist, the individual may sit down and

remove one leg at a time from the chemical protective suit and boot. Once removed, the garment should be inside out with all contamination on the inside. The attendant will place moisture-resistant booties on the individual's feet. Disposable outer garments will be placed in an appropriate container for sampling and disposal. Reusable garments will be placed in a lined container for monitoring and proper cleaning.

STEP 5. *Inner Clothing Removal.* The EDS System Manager, in coordination with the SHO, will decide if inner clothing removal is necessary. Otherwise, only inner gloves will be removed at this station. If all or most of an individual's inner clothing is removed, a robe and slippers will be issued. The PDS operator will ensure that all clothing is appropriately containerized for sampling and disposal as required.

a. *Equipment.* Drum or similar container with tightly or self-closing lids, plastic-covered bench or chairs, boot jack (if available), robes, and slippers

b. *Action.* If directed by the EDS System Manager, in coordination with the SHO, the individuals will remove their inner garments, assisted by a PDS attendant if necessary, and place them in the proper container.

Warning: Ensure that respiratory protective device (RPD) facepiece remains fully sealed and in place until instructed to remove.

STEP 6. *Respirator Removal.* The individual will remove his/her RPD and place it in the designated receptacle. The individual then will leave the PDS. A PDS attendant will move the RPDs to the equipment decontamination area. After decontamination, masks will be placed in plastic bags, marked to indicate the wearer's name, and placed in a storage box to await monitoring and cleaning for reissue.

a. *Equipment.* Box with liner and plastic bags

b. *Action.* Remove RPD and place in plastic bag. Attendant will disconnect airline from mask, as appropriate, and mark mask to indicate the wearer's name. Then, place bagged RPD in storage box to await monitoring and proper cleaning. Proceed to building shower facilities.

STEP 7. *Shower and Redress.* The individual will take a full shower in the shower facility, redress, be checked by a medical technician, and report to the EDS Crew Chief.

a. *Equipment.* Portable or fixed shower facilities, soap, shampoo, washcloths, and towels

b. *Action.* Take full-body shower (thoroughly wash hands, hair, neck, and face). Then, exit the shower, dry off, redress, and report back to the EDS Crew Chief for further instructions.

Eyewashes are available for immediate use as required. Splash protection can be washed and rinsed at the PDS, as required, with the approval of the EDS System Manager/SHO. Should a worker's skin be exposed to liquid contamination, the worker will be completely processed through the PDS.

Workers wearing splash protection that has not come in contact with liquid contamination will remove and store or dispose of protective clothing when the assigned task is completed. If SCBAs are used during operations and air monitoring indicates that the concentration of hazardous chemicals was below the workplace exposure limit, the respirator may be removed without decontamination. The face mask, however, will be cleaned before being worn by a different worker.

7.3 Emergency Personnel Decontamination Station (EPDS) Procedures

EPDSs will be established as needed if there is a chemical agent spill outside of engineering control. The EPDS will be arranged similar to the PDS described in paragraph 7.2 of this HASP. The EPDS will be operated according to established TEU procedures.

7.4 Equipment Decontamination

Equipment used outside the EDS exclusion zone should not encounter contamination under routine operations. Should chemical agent above the TWA be detected outside the exclusion zone and equipment be potentially contaminated, that equipment will be monitored and decontaminated if necessary, according to established TEU procedures.

Equipment used inside the VCS that may have been contaminated with chemical agent will be decontaminated in the PDS after personnel have finished being decontaminated. Any equipment requiring decontamination will be wiped down with a decontamination reagent, such as 5 percent bleach in water, using a brush, sponge, or cloth. Then, the item will be rinsed with clean water and allowed to dry. After drying, the item will be bagged or placed in a shroud, allowed to equilibrate, and monitored for contamination. If contamination above the 1.0 TWA is detected, the item will be decontaminated again. After decontamination, items will be bagged and tagged to indicate the level of decontamination.

7.5 Decontamination Waste Disposal

Liquid waste and disposable PPE produced at the PDS will be placed in containers that meet DOT standards and will be turned over to DPG for disposition. The EDS Destruction Plan describes waste management practices. Reusable PPE will be handled in accordance with Army policies concerning monitoring and laundry. Every attempt will be made to reduce contamination on equipment to levels as low as reasonably achievable. Whenever possible, soap/detergent and water will be used as

decontaminants. Reusable PPE contaminated by blood will be stored and handled separately in accordance with Army policy.

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SECTION 8
EMERGENCY RESPONSE/CONTINGENCY PLAN

The EDS has been engineered in compliance with the PMNSCM *System Safety Management Plan* in order to reduce risks.

8.1 Specific Contingency Plans

Contingency plans for the site include measures to prevent emergencies or, if any emergency occurs, to limit the negative impact. The major aspects of these plans are:

- *Preventive Measures.* Measures that should prevent or limit an emergency incident
- *Response Actions.* Specific actions to be taken as a specific response to an emergency situation
- *Notification.* Response organizations or personnel to be notified in case of an emergency.

8.1.1 Preventive Measures. The following measures will be implemented to prevent or limit an emergency incident:

a. Strictly adhere to the SOPs, including the use of prescribed PPE during all onsite activities.

b. Set up the PDS prior to work with hazardous materials.

c. Determine the evacuation route and rally point, and communicate it to workers during the daily safety briefing.

d. Keep standard absorbent materials, shovels, and overpacks onsite to contain a spill or leak.

e. Discontinue operations when inclement/hazardous weather conditions pose a threat to the safe working environment or if it is riskier to continue operations. Some of the items to be considered prior to determining if work should continue are:

(1) Potential for heat or cold stress and heat or cold related injuries

(2) Severe weather-related working conditions (for example, fog, heavy rain)

(3) Potential for electrical storms.

8.1.2 Response Actions.

a. *Medical Emergency.* In the event of a medical emergency (potential or actual, serious or life-threatening injuries or illnesses) at the site, perform the following procedures:

- The injured EDS team member's buddy shall signal the EDS Crew Chief/SHO via hand signals, voice, or radio that an injury has occurred.

- The DPG Range Control will be notified. The answering party will be told of the type and nature of the emergency, the current location and what, if any, first aid was administered.

- A trained and qualified EDS team member may administer first aid if needed.

- If the medical emergency involved chemical agent contamination, the patient will be fully decontaminated before transport.

If medical treatment appears to be necessary, the following medical facilities will be used for emergency care. The DPG ambulance crew will know which medical facility to use and are familiar with the routes.

Trauma and non-chemical agent exposed patients may be taken to:

U.S. Army Health Clinic
Phone: 435-831-2211

Chemical agent exposed patients may be taken to:

DITTO Aid Station
Phone: 435-831-5292

The EDS System Manager and the SHO are responsible for completing an accident report (Department of the Army [DA] Form 285) within 24 hours of the incident. Copies of the accident report shall be provided to the CMA-RMD and the Supervisor/Safety Manager of the victim's organization.

Any occurrence involving the potential exposure of site personnel to CWM must be treated as an emergency situation as the effects of the exposure may be immediate or delayed.

b. *Spill Containment Program.* Any release of chemical agent outside of engineering controls will be handled in accordance with the DPG Chemical Accident/Incident Response and Assistance (CAIRA) Plan.

c. *General Response Actions.* The following paragraphs cover general response actions. Specific response actions are patterned after these general actions and are detailed in SOPs for individual tasks.

(1) *Evacuation.* In the event of an emergency situation, such as fire or release of toxic materials outside of engineering control, individuals will evacuate upwind to a predetermined rally point. A release of toxic material inside the VCS normally will not require evacuation, as workers inside the VCS will be wearing Level C PPE. VCS workers will attempt to identify the source of the toxic material and implement steps for containment and decontamination. The EDS System Manager/SHO will initiate proper action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the CRZ once the emergency signal has been given, unless authorized.

Once the safety of all onsite personnel is established, the personnel identified in paragraph 8.1.3 will be notified of all emergencies.

(2) *Potential or Actual Fire.* The EDS has been designed to minimize the possibility of a fire associated with the system. The EDS uses electrically powered equipment, combustible liquid (MEA), and compressed gas (helium) in operations.

When a worker discovers a fire, he or she will sound an alarm. The operator must inform the EDS System Manager of the size and location of the fire.

If the fire is small, the operators may attempt to put it out using a portable fire extinguisher. If this attempt is successful, the worker will inform the EDS System Manager of the fire status. If the fire is large, involves materials that present an increased hazard to the

worker, or the first attempt to control the fire was unsuccessful, all workers will evacuate the area and inform the EDS System Manager.

The EDS System Manager will contact the EOC and request assistance. This contact should include the type and size of the fire, the location of the fire, and the method for contacting the EDS System Manager. The EDS System Manager will account for all personnel, including visitors, on the site.

(3) *PPE Failure.* If any site worker experiences a PPE failure that affects the protectiveness or usability of the equipment, that person will immediately inform the EDS Crew Chief and report to the PDS for assistance. Re-entry to the EDS operations area will not be permitted until the equipment has been repaired or replaced and the EDS System Manager/SHO has granted permission.

(4) *Physical Injury.* Emergency first aid shall be applied onsite as necessary. A first-aid kit is available at the PDS. For minor non-emergency physical injuries requiring medical treatment beyond onsite first aid, the casualty will be transported to the nearest healthcare facility.

(5) *Industrial Chemical Exposure.* Typical responses to chemical exposure emergencies shall include:

- *Inhalation.* Move to fresh air and call for emergency assistance as indicated in the subsequent paragraphs.

- *Skin Contact.* Use copious amounts of soap and water. Wash and rinse affected area thoroughly, and then provide appropriate medical attention. An eyewash station will be

provided at the EDS PDS. Eyes should be rinsed for 15 minutes upon industrial compound exposure. Drenching, if required, will be performed at the PDS.

- *Ingestion.* Call for emergency assistance as indicated in the following paragraphs and process through PDS immediately.

- *Puncture Wound or Laceration.* Call for emergency assistance as indicated in the subsequent paragraphs. If chemical materials are involved, process through PDS immediately. If no chemical materials are involved, processing through PDS is not required.

For emergency injuries, medical assistance must be summoned onsite through notification as follows:

- Dial EOC and request medical assistance (if injury occurs at a time when ambulance is not onsite).

- If the casualty was exposed to any chemical material, the EDS System Manager/SHO will supply MSDSs to the medical personnel.

(6) *Exposure to Chemical Agent.* If exposure to chemical agent is suspected or symptoms of agent exposure develop, operators will hold their breath and immediately don escape masks, sound the air horn (one long blast) or give a verbal warning (if workspace alarm has not sounded), and report to the PDS.

Casualties will be processed through the PDS as injuries permit. Decontamination will not be delayed until the arrival of medical personnel unless physical injuries prevent safe movement of the

casualty. Operators not showing symptoms of agent exposure will be processed through the PDS and stand by for further instructions.

8.1.3 Notification. The primary responsibility for notification lies with the EDS System Manager with assistance from all other field personnel. Tables 8-1 and 8-2 provide information for the responsible person or agency.

8.2 Emergency Equipment

The following emergency equipment is positioned as follows:

a. *Emergency Eyewash.* Located at the PDS

b. *First-Aid Kits.* Located at PDS

c. *Stretcher.* Located at PDS

Table 8-1. Emergency Notification

Situation	Telephone Number	Agency
Fire	911	DPG Security Dispatch
Medical Emergency (Ambulance)	• Direct contact or local radio net • 911 (when ambulance is not onsite)	• Onsite ambulance crew
Chemical Agent Release Outside of Engineering Control	911	DPG Fire Department
Spill of Industrial Compounds Requiring Outside Assistance	911	DPG Fire Department
All Emergencies	Per DPG Radio Network 110	DPG Range Control DPG EOC

Notes:

DPG = Dugway Proving Ground
EOC = Emergency Operations Center

Table 8-2. PMNSCM Emergency Notification Phone Numbers

Situation	Agency	Remarks
Accident Reporting	CMA-RMD	This notification made by EDS System Manager
	Safety/Surety/Security Office (ECBC)	This notification made by EDS System Manager
Chemical Event	Safety/Surety/Security Office (ECBC)	This notification made by EDS System Manager
Non-emergency Change in Level of PPE Required	CMA-RMD	This notification made by EDS System Manager
	Safety/Surety/Security Office (ECBC)	This notification made by SHO
Start of Operations and Daily Operations	DPG Range Control	Daily reporting

Notes:

CMA = U.S. Army Chemical Materials Agency
DPG = Dugway Proving Ground
ECBC = Edgewood Chemical Biological Center
EDS = Explosive Destruction System
POC = point of contact
PPE = personal protective equipment
RMD = Risk Management Directorate
SHO = Safety and Health Officer

d. *Fire Extinguishers.* Located in the VCS at the personnel entry/exit door, in the monitoring room, and at the PDS.

8.3 Emergency Signals

Emergency communication will be via the radio communication sets worn by the EDS Operators, two-way radios, and/or cellular phone. Should a chemical event from another area of the site threaten EDS personnel, EDS workers will be notified by radio. All workers will don escape masks and evacuate as instructed.

The EDS Crew Chief/SHO will discuss emergency communications and the impact of possible emergencies from operations in adjacent areas during team safety briefings.

Appendix H, Evacuation Plan, identifies essential and non-essential personnel, and communications system used. It also describes the emergency signals that will be used and actions to be taken if an emergency situation occurs.

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SECTION 9
GENERAL SAFETY

9.1 General Work Rules

9.1.1 Site Safety Training. Safety briefings will be held at the site before project startup and daily throughout the project. All site safety briefings will be documented in a daily log. Additional training requirements are described in section 11 of this HASP.

9.1.2 Buddy System. Since treatment of recovered chemical munitions is a hazardous waste operation, all work will be performed in accordance with the "buddy system" requirements, as defined in 29 CFR 1910.120.

9.1.3 Housekeeping. All work areas will be kept in a neat and orderly condition.

9.1.4 Fire Lanes. Designated access areas (fire lanes) surrounding the EDS operations area will be maintained at all times. Site trailers must be positioned to not block roads or entrances/exits to any buildings. Vehicles must be parked with enough clearance for firefighting and other emergency equipment to access the area, if required.

9.1.5 Restrictions. No eating, drinking, smoking, or other practices that increase the probability of hand-to-mouth transfer and ingestion of contaminated material will be allowed within the EDS operations area except in the designated break area and in administrative areas of the support zone. Drinking water will be located in the break area. Smoking materials will be permitted only within administrative areas of the site. Smoking is allowed only in designated areas outside buildings and away from explosives storage areas.

No jewelry or other articles that interfere with the use of protective clothing will be worn. No beards, sideburns, mustaches, or long hair that interfere with facemask seals will be permitted.

In case of conflict, the EDS System Manager, with input from the SHO, will be the final judge in determining the appropriateness of any object, feature, or activity that could cause interference or lead to a potentially unsafe condition.

9.1.6 Documentation. The following documentation will be adhered to during all EDS operational activities:

a. *Log In/Out Form.* Each person (including visitors) entering the EDS Site will be required to sign in and out in the daily log located at the PDS. The log will include the person's name, as well as the date and time of entry and exit.

b. *Accident/Mishap Report.* An accident report will be made via telephone by the EDS System Manager/SHO when any one or more of the following occur as a result of an accident or incident: fatality, injury that requires medical attention, occupational illness, damage to safety equipment, fire, chemical exposure, or hazardous material spill. The telephone report will be made to CMA-RMD per Program Manager for Chemical Demilitarization (PMCD) Regulation 385-3 and PMCD Policy Statement No. 25 as soon as possible after occurrence. EDS notification numbers are listed in section 8 of this HASP.

The EDS System Manager will document circumstances surrounding the accident. Additional documentation may be required by the supporting safety office or CMA-RMD.

DA Form 285, *U.S. Army Accident Investigation Report*, will be prepared by the SHO as required by Army regulations.

c. *Site Safety Record.* A daily record of safety briefings (attendance and topics discussed), inspection of safety equipment, and records of accidents and incidents will be maintained in the command post by the EDS System Manager.

d. *References Maintained Onsite.* The following reference documents will be maintained at the site:

(1) *MSDSs.* MSDSs for CWM and all industrial/military compounds used at the site will be maintained and be available at the command post.

(2) *HASP.* An up-to-date copy of this HASP will be kept at an easily accessible location onsite. All EDS personnel will acknowledge having read and understood the HASP by signing an acknowledgment form kept onsite.

(3) *EDS O&M Manual.* A copy of the final O&M Manual will be maintained onsite.

(4) *SOPs.* All site SOPs will be maintained onsite.

(5) *Manuals of Other Site Equipment.* Operator's manuals, O&M manuals, etc. for site equipment, such as monitoring devices and respiratory protection devices, will be maintained onsite.

9.1.7 Deviation from or Modification of HASP. The RMD and the EDS System Manager must approve any change to this HASP (other than editorial) before they are published. Workers affected by the changes will be trained to the new requirements before the changes are implemented. The EDS Crew Chief may initiate requests for deviation/modification and obtain concurrence from all parties, as outlined in table 2-1, Safety Responsibilities.

9.2 Accident Prevention Plan

9.2.1 Administration.

a. *Administrative Responsibilities.* The EDS System Manager has primary responsibility for implementing this Accident Prevention Plan. The EDS Crew Chief/SHO must ensure that all EDS personnel are knowledgeable about the specific accident prevention measures designated. It will be the responsibility of each worker to implement this plan. Refer to figure 2-1 for a summary of project health and safety administration.

b. *Local Requirements.* All site requirements for safety and security will be followed. The EDS System Manager, EDS SHO and the DPG Safety Office will resolve any conflicts between this HASP and the Final Safety Submission. Upon resolution, appropriate changes will be made to the affected documents.

c. *Safety Training.* All EDS personnel shall receive site-specific and task-specific health and safety training.

d. *Hazard Marking.* Hazard marking will be accomplished in accordance with AR 385 series with input from the supporting safety office or fire chief. The work site will be marked with the appropriate chemical agent symbols.

e. *Fire Protection/Emergencies.* Fire protection onsite shall be in accordance with 29 CFR 1910.120.

f. *Inspection.* The EDS System Manager, Crew Chief, and SHO shall conduct periodic inspections of the EDS site and equipment. All observed physical and chemical hazards not specifically addressed in the HASP, which require corrective actions, shall be documented.

g. *Accident Investigation Procedures.* Should an accident occur onsite, an accident investigation will be conducted in accordance with AR 385-40.

h. *Temporary Power Distribution.* Temporary power distribution systems must be installed by a qualified electrician.

i. *Trailer Anchoring System.* All trailers will be anchored where required by local codes.

j. *Severe Weather.* Work stoppage will occur in the event of severe weather in accordance with site general safety requirements.

9.2.2 Lockout/Tagout. EDS workers must be protected from energy sources during maintenance activities by using lockout/tagout procedures that comply with OSHA regulation 29 CFR 1910.147. Guidelines are provided in appendix F to this HASP.

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SECTION 10
MEDICAL SURVEILLANCE

10.1 Health Monitoring

EDS workers will participate in a comprehensive health-monitoring program as required by AR 40-5, *Preventive Medicine*, and OSHA 29 CFR 1910.120(s). The medical surveillance program shall be developed based on the specific needs, location, and potential exposure of workers at the work site. The program will include preplacement, periodic, and termination physical examinations.

Contractor personnel involved in EDS operations are required to be enrolled in a corporate medical surveillance program, as required by OSHA 29 CFR 1910.120(f).

10.1.1 Initial Medical Monitoring. The initial screening of Army personnel will be performed in accordance with AR 40-5. The screening will include a physical examination to determine the worker's ability to wear protective clothing, including APRs.

As a minimum, the following initial medical screening is required:

- Occupational history
- Medical history
- Physical exam
- Clearance for respiratory protection.

10.1.2 Periodic Monitoring. Periodic monitoring will include annual updates based on exposure information obtained during the intervening year. Periodic physicals will be

performed as determined by the physician. As new exposure hazards are identified, the baseline health hazard inventory will be expanded, and the content of the medical surveillance examinations will be appropriately modified. The site monitoring supervisor will provide any monitoring records to appropriate Army and contractors' safety offices for any employee exposed to chemical materiel.

10.1.3 Specific Monitoring. If any worker is injured, develops an occupational illness, or displays signs or symptoms of possible exposure to health hazards, medical examinations and consultations shall be made according to the following schedules:

a. As soon as possible following an injury, onset of illness, or development of signs or symptoms

b. At times when an examining physician or certified industrial hygienist determines a worker is at risk due to overexposure

c. At additional times, if the examining physician determines that follow-up examinations or consultations are medically necessary.

10.1.4 Project Completion Examination. EDS workers will be medically examined at termination of their employment or reassignment to an area where the employee would not be covered by medical monitoring requirements if the worker has not had an examination within the last 6 months.

10.1.5 Daily Physical. Each day, as workers report to duty, onsite medical support personnel will check the vital signs of each EDS worker and observe them for signs of illness or injury that could interfere with the performance of their assigned tasks, including their ability to wear prescribed PPE.

10.2 Documentation and Recordkeeping Requirements

At the site, the EDS Crew Chief will maintain a current chemical duty position roster noting personnel that are able to operate the EDS. Personnel listed on this roster currently meet medical training and medical surveillance requirements. The EDS Crew Chief will provide the list to the EDS System Manager and update as necessary. Copies of required medical and training records shall be kept at the command post or other site administrative area. Each organization and contractor shall provide the appropriate records. Any visitor or observer approved for entry into any work area will be required to provide a copy of a physician's written opinion or acceptable substitute to the SHO prior to site entry. The physician's written opinion of approval must be dated within 12 months of site entry.

The EDS SHO will be responsible for recording and reporting illnesses and injuries in accordance with OSHA requirements. Maintenance of OSHA Log 200 will be the responsibility of the injured individual's supporting safety office. Recordable occupational accidents and illnesses are those defined in OSHA standards 29 CFR 1910 and 1926. Should a recordable injury or illness involve an Army employee, it will be reported to the supporting safety office. Recording and reporting for CMA personnel will be handled in accordance with PMCD Regulation 385-3. Should an accident or illness involve a contract employee, it will be reported in accordance with the respective corporate plan, as well as the supporting government safety office.

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SECTION 11
EMPLOYEE HEALTH AND SAFETY TRAINING REQUIREMENTS

The following paragraphs describe training requirements and table 11-1 summarizes those requirements.

11.1 Offsite Training

Before arriving onsite, all personnel will be certified to meet the minimum training requirements outlined in 40 CFR 264.16 and in OSHA standard 29 CFR 1910.120 concerned with Hazardous Waste Operations and Emergency Response. Certification records will be maintained by each worker's organization. Each organization will provide verification of training to the EDS System Manager. These requirements specify that employees must have completed the following:

a. Forty hours of initial training, consisting of classroom and hands-on experience in the use of PPE, safe operating practices, identification of potential hazards and hazardous situations, etc., in accordance with OSHA standard, or 24 hours of training for workers onsite for specific tasks (for example, auditors)

b. Eight hours of annual refresher training

c. Eight hours of specialized supervisory training for personnel serving as supervisory staff

d. Three days of work activity under the supervision of a trained and experienced supervisor for new employees

e. First aid and cardiopulmonary resuscitation (CPR) training.

Table 11-1. Training Requirements[a] of EDS Workers

Required Training	Job Description					
	Non-routine Workers	EDS System Manager	Site Safety and Health Officer	EDS Crew Chief	EDS Operator	Explosives Operator
Compliance Training						
CPR/First Aid[b]		X	X	X	X	X
HAZCOM (OSHA 1910.1200)[c]	X	X	X	X	X	X
HAZWOPER (OSHA 1910.120)[d]	X	X	X	X	X	X
HAZWOPER Supervisor (8-hour OSHA 1910.120)		X		X		
RCRA Compliance		X		X	X	X
Site Orientation	X	X	X	X	X	X
Operator Training						
EDS Operating Systems (trailer, vessel, hydraulic systems, reagent supply system, electrical systems, helium leak detection, waste transfer system)				X	X	X
EDS Setup				X	X	X
Manage and Process Hazardous Wastes				X	X	X
Munition Processing				X		X
Chemically Treat Munition Fill				X	X	

Table 11-1. Training Requirements[a] of EDS Workers (Continued)

Required Training	Job Description					
	Non-routine Workers	EDS System Manager	Site Safety and Health Officer	EDS Crew Chief	EDS Operator	Explosives Operator
Other-Than-Normal Operations				X	X	X
Final Shutdown and Closeout				X	X	X
Preparation for Movement of the EDS Phase 1				X	X	X

Notes:

[a] Actual training requirements will depend on the existing skill level for each individual who may have already had equivalent training and experience and will be based on a job task analysis (JTA).
[b] Annual recertification required
[c] Annual refresher required
[d] Annual 8-hour refresher required

CPR = cardiopulmonary resuscitation
EDS = Explosive Destruction System
HAZCOM = hazard communication
HAZWOPER = Hazardous Waste Operations and Emergency Response
OSHA = Occupational Safety and Health Administration
RCRA = Resource Conservation and Recovery Act of 1976

11.2 Work-Specific Training

All employees will receive training specific to the tasks they are expected to perform. Vehicle drivers and heavy equipment operators will be licensed for the vehicles or equipment they will operate. Records of this training, licensing, and certification will be maintained at the site.

11.3 Site-Specific Training

Before startup, all personnel will receive a pre-work briefing by the SHO. The following topics will be addressed:

a. Names of personnel and alternates responsible for site health and safety

b. Safety, health, and other hazards present onsite as documented in the Hazard Analysis (HA), as well as additional hazards, if any, found during site activities

c. Use of site-specific PPE

d. Work practices that will minimize risks from hazards and exposures

e. Safe use of engineering controls and equipment that are present onsite

f. Physical and chemical health hazards, including recognition of symptoms and signs that may indicate overexposure to such hazards

g. Emergency response/contingency plans, including notification process and routes of escape

h. Implementation of the "buddy system"

i. Any other site-specific features as deemed necessary by the SHO

j. Inspection of all power equipment at the start of each day

k. Use, inspection, repair, and replacement of emergency and monitoring equipment.

Any other health- and safety-related topics that arise prior to startup also will be discussed at the pre-work briefing. Issues that may arise during implementation of this Plan will be addressed during daily safety meetings, prior to shift startup. Any changes in procedures or site-specific health- and safety-related matters will be addressed during these meetings.

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APPENDIX A
ACRONYMS/ABBREVIATIONS

APPENDIX A
ACRONYMS/ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
APR	air-purifying respirator
AR	Army Regulation
ASTM	American Society for Testing and Materials
BEI	Biological Exposure Indices
Btu/hr	British thermal unit per hour
CAIRA	Chemical Accident/Incident Response and Assistance
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CMA	U.S. Army Chemical Materials Agency
CPR	cardiopulmonary resuscitation
CRZ	contamination reduction zone
CSC	conical-shaped charge
CWM	chemical warfare materiel
DA	Department of the Army
DA Pam	Department of the Army Pamphlet
DAAMS	Depot Area Air Monitoring System
dB(A)	decibels using an "A" weighted scale
DOT	Department of Transportation
DPG	Dugway Proving Ground
EBA	escape breathing apparatus
ECBC	Edgewood Chemical Biological Center

EDS	Explosive Destruction System
EMT	emergency medical technician
EOC	Emergency Operations Center
EPDM	ethylene propylene diene monomer
EPDS	Emergency Personnel Decontamination Station
GB	sarin
H	sulfur mustard
HA	Hazard Analysis
HASP	Health and Safety Plan
HEPA	high efficiency particulate air
IDLH	immediately dangerous to life and health
kcal/hr	kilocalorie per hour
LSC	linear-shaped charge
MEA	monoethanolamine
mg/m^3	milligram per cubic meter
MIL-STD	Military Standard
mL	milliliter
mm	millimeter
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NRT	near real-time
O&M	operations and maintenance
OSHA	Occupational Safety and Health Administration

P1U3	Phase 1 Unit 3
PDS	Personnel Decontamination Station
PMCD	Program Manager for Chemical Demilitarization
PMNSCM	Product Manager for Non-Stockpile Chemical Materiel
PPE	personal protective equipment
psi	pounds per square inch
RDX	cyclonite
RMD	Risk Management Directorate
RPD	respiratory protective device
SAR	supplied air respirator
SCBA	self-contained breathing apparatus
SHO	Safety and Health Officer
SOP	Standing Operating Procedure
SSHO	Site Safety and Health Officer
TB	Technical Bulletin
TEU	U.S. Army Technical Escort Unit
TLV	Threshold Limit Value
TNT	trinitrotoluene
TSDF	treatment, storage, and disposal facility
TWA	time-weighted average
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
VCS	Vapor Containment System
WBGT	Wet-Bulb Globe Temperature

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APPENDIX B
CHEMICAL LIST

APPENDIX B
CHEMICAL LIST

Table B-1 contains a list of all chemicals/substances expected to be used for operation and maintenance of the Explosive Destruction System (EDS). The EDS Safety and Health Officer should maintain a copy of the Material Safety Data Sheet for each chemical/substance at the EDS Site in a location where they are conveniently available for the workers.

Table B-1. Chemical List

Item	Part Number/ Vendor Number	Source	Intended Use
(ASZM TEDA 12-30 Mesh Fill)	Unisorb Dwg# 981208	Unisorb	Vapor filtration
Acetic Acid (Vinegar)	N/A	Local purchase	Vessel rinse
Acetone (97% to 100%)	27,072-5	Sigma-Aldrich (Chemical supplier)	Reagent
Boelube	70200-13	The Orelube Corp.	Lube valve fittings on vessel
Bulk Explosives/Blasting Caps	N/A	EOD	Unexpected operations (open detonation of bursters of explosive chunks that survive treatment)
Conex Lubricant w/Brush	N/A	Conex Buffalo Technologies	Lubricate feedthroughs
Conical-Shaped Charge	TT185393	SNL (New Mexico) Marconi	Munitions destruction
Denatured Alcohol 90-95% Ethanol with 5% Methanol and/or 5% Isopropanol	N/A	Sigma-Aldrich (Chemical supplier)	Reagent
Desensitized RDX	N/A	EOD	Munitions destruction
Ethanol (Denatured)	N/A	Sigma-Aldrich (Chemical supplier)	Reagent
Ethyl Acetate (99.5+%)	N/A	Aldrich Chemical Co. Inc. (Chemical supplier)	Remove PermaSlik®
EBW Detonator (for Conical Shaped Charge)	188-7343	Reynolds	Munitions destruction
EBW Detonator (for Linear Shaped Charge)	188-7344	Reynolds	Munitions destruction
Fluorescent Paint, Orange	N/A	Local purchase	Mark FSS
Fluorolube Grease	N/A	Chemical supplier	Lubricating pressure gauge fittings
Fluorolube Oil	N/A	Chemical supplier	Damping pressure gauge to eliminate erratic readings
Grease, Multipurpose	N/A	Local purchase	Grease fittings
Helium Pressurized Gas, 150 mL Canister, 140 psi	N/A	Industrial gas supplier	Leak detector testing
Helium Purity, Compressed, 99.99%	N/A	Industrial gas supplier	Vessel leak detecting

Table B-1. Chemical List (Continued)

Item	Part Number/ Vendor Number	Source	Intended Use
Hydra Oil, Wanner (EPMD-F/G 20W)	A01-114-3407	Wanner Engineering	Lubricate supply pump
Hydrogen, Compressed	N/A	Industrial gas supplier	Monitoring
Linear-Shaped Charge		AES	Munitions destruction
Loctite	N/A	Local purchase	Nut and bolts
Mobil DTE 25 Hydraulic Oil	Mobil DTE 25	Mobil Oil Corp.	Hydraulic system and tensioner pump
Monoethanolamine - MEA 97% to 100%	N/A	Sigma-Aldrich (Chemical supplier)	Reagent - (Retain 1 drum during other munition campaigns for unexpected ops.)
Monoethanolamine - MEA 45%	N/A	Sigma-Aldrich (Chemical supplier)	Reagent - (Retain 1 drum during other munition campaigns for unexpected ops.)
Nitrogen, 99.999%	N/A	Industrial gas supplier	GC/MSD and MINICAMS®
Mustard (H)	N/A	DoD	Materiel to be treated in EDS
Oil, 10W30	N/A	Local purchase	Coleman Powermate Compressor
PermaSlik RAC (10-137)	No vendor # - order by item name	EM	Vessel seal lubricant
Pneumatic Lubricating Oil	AD 220	Gast Mfr Corp	Lubricate air driven drum pump and double diaphragm air pump
Sarin (GB)	N/A	DoD	Materiel to be treated in EDS
Silica Gel	N/A	Chemical supplier	Moisture absorbent
Sodium Bisulfite, Assay >55% SO_2	24,397-3	Sigma-Aldrich (Chemical supplier)	Reagent
Sodium Hypochlorite Solution (Bleach 5.25% Nominal)	N/A	Local purchase	General purpose decontaminant
Trinitrotoluene (TNT)	N/A	Radford Army Ammunition Plant (EOD)	Munitions destruction
Vacuum Grease, Dow Corning	1204K52 (5.3 oz) 1204K58 (8 lbs)	McMaster Carr	Used to lubricate seals

Table B-1. Chemical List (Continued)

Item	Part Number/ Vendor Number	Source	Intended Use
Vacuum Pump Fluid (Oil)	1099	Alcatel Vacuum Products Inc.	Used for vacuum pump and leak detector
WD 40 Aerosol	N/A	Local purchase	General purpose lubricant

Notes:

DoD = Department of Defense
EBW = exploding bridge wire
EOD = explosive ordnance disposal
FSS = fragment suppression system
GC/MSD = gas chromatograph/mass selective detector
MEA = monoethanolamine
mL = milliliter
N/A = not applicable
psi = pounds per square inch
RDX = cyclonite
SNL = Sandia National Laboratory

APPENDIX C
HEAT STRESS GUIDELINES

APPENDIX C
HEAT STRESS GUIDELINES

The following information is based on chapter 4 of the Occupational Safety and Health Administration (OSHA) Technical Manual TED 1-0.15A, (OSHA, 1999).

C.1 Heat Stress Threshold Limit Values

The heat stress Threshold Limit Values (TLVs) specified in table C-1 refer to heat stress conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse health effects. These TLVs are based on the assumption that nearly all acclimatized, fully clothed (for example, lightweight pants and shirt) workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep-body temperature of 38°C (100.4°F).

Table C-1. Examples of Permissible Heat Exposure TLVs
[Values are given in °C and (°F) WBGT]

	Work Load					
	Light		Moderate		Heavy	
Work-Rest Regime	Level D PPE	Level A, B, & C PPE	Level D PPE	Level A, B, & C PPE	Level D PPE	Level A, B, & C PPE
Continuous Work	30.0 (86)	20.0 (68)	26.7 (80)	16.7 (62)	25.0 (77)	15.0 (59)
75% Work – 25% rest per hour	30.6 (87)	20.6 (69)	28.0 (82)	18.0 (64)	25.9 (78)	15.9 (60)
50% Work – 50% rest per hour	31.4 (89)	21.4 (71)	29.4 (85)	19.4 (67)	27.9 (82)	17.9 (64)
25% Work – 75% rest per hour	32.2 (90)	22.2 (72)	31.1 (88)	21.1 (70)	30.0 (86)	20.0 (68)

Note:

PPE = personal protective equipment

Where there is a requirement for protection against other harmful substances in the work environment and additional personal protective clothing and equipment must be worn, a correction to the Wet-Bulb Globe Temperature (WBGT) TLV values must be applied.

Since measurement of deep body temperature is impractical for monitoring the workers' heat load, the measurement of environmental factors is required, which most nearly correlate with deep-body temperature and other physiological responses to heat. At the present time, the WBGT Index is the simplest and most suitable technique to measure the environmental factors. WBGT Index values are calculated by the following equations:

a. Outdoors with solar load:
WBGT = 0.7 NWB + 0.2 GT + 0.1 DB

b. Indoors or outdoors with no solar load:
WBGT = 0.7 NWB + 0.3 GT

where:
DB = dry-bulb temperature
GT = globe temperature
WBGT = Wet-Bulb Globe Temperature
NWB = natural wet-bulb temperature.

Higher heat exposures than those shown in table C-1 are permissible if the workers have been undergoing medical surveillance and it has been established that they are more tolerant to work in heat than the average worker. Workers should not be permitted to continue their work when their deep-body temperature exceeds 38°C (100.4°F).

C.2 Evaluation and Control

C.2.1 Measurement of the Environment. The instruments required are a dry-bulb thermometer, a natural (static) wet-bulb thermometer, a globe thermometer, and a stand for hanging the thermometers. Measurements will be documented in a daily log.

The range of the dry and the natural wet-bulb thermometers should be -5°C to +50°C (23°F to 122°F) with an accuracy of ±0.5°C. The dry-bulb thermometer must be shielded from the sun and the other radiant surfaces in the environment without restricting airflow around the bulb. The wick of the natural wet-bulb thermometer should be kept wet with distilled water for at least 1/2 hour before the temperature reading is made. If the wick is not kept continuously wet, it should be wetted by direct application of water from a syringe or squirt bottle and the reservoir filled 1/2 hour before each reading. The wick should extend over the bulb of the thermometer, covering the stem about one additional bulb length. The wick should always be clean and new wicks should be washed before using.

A globe for the globe thermometer should consist of a 15-centimeter (6-inch) diameter hollow copper sphere painted on the outside with a matte black finish or equivalent. The bulb or sensor of a thermometer [range -5°C to +100°C (23°F to 212°F) with an accuracy of ±0.5°C] must be fixed in the center of the sphere. The globe thermometer should be exposed to sunlight and/or other radiant heat sources at least 25 minutes before it is read.

A stand should be used to suspend the three thermometers so that they do not restrict free airflow around the bulbs, and the wet-bulb and globe thermometers are not shaded.

It is permissible to use any other type of temperature sensor that gives a reading identical to that of a mercury thermometer under the same conditions.

The thermometers must be placed so that the readings are representative of conditions the workers will experience.

C.3 Work Load Categories

Heat produced by the body plus heat absorbed from the environment determines the total heat load. As people work harder they will increase their total heat load even when environmental conditions remain constant. Therefore, the workload category of each job should be established and the heat exposure limit appropriate for that workload should be evaluated against the applicable standard to protect the worker exposure beyond the permissible limit.

The workload category is established by ranking each job as light, medium, or heavy workload based on the amount of physical activity required:

a. Light work [up to 200 kilocalorie per hour (kcal/hr) or 800 British thermal units per hour (Btu/hr)], for example, sitting or standing to control machines, or performing light hand or arm work

b. Moderate work (200-300 kcal/hr or 800 to 1,400 Btu/hr), for example, walking about with moderate lifting and pushing

c. Heavy work (350 to 500 kcal/hr or 200 to 1,400 Btu/hr), for example, pick and shovel work.

After the workload has been ranked into one of the three categories, the permissible heat exposure TLV can be estimated from table C-1 or calculated using tables C-2 and C-3.

The ranking of the job may be performed either by measuring the worker's metabolic rate while performing a job or by estimating the worker's metabolic rate with the use of tables C-2 and C-3.

Table C-2. Assessment of Work Load

Average values of metabolic rate during different activities:			
A. Body position and movement		Kcal/min	
Sitting		0.3	
Standing		0.6	
Walking		2.0 to 3.0	
Walking up hill		Per meter (yard) rise	
B. Type of Work		Average Kcal/min	Range Kcal/min
Hand work	*light* *heavy*	0.4 0.9	0.2 to 1.2
Work with one arm	*light* *heavy*	1.0 1.7	0.7 to 2.5
Work with both arms	*light* *heavy*	1.5 2.5	1.0 to 3.5
Work with body	*light* *moderate* *heavy* *very heavy*	3.5 5.0 7.0 9.0	2.5 to 15.0

Table C-3. Activity Examples

• Light hand work: writing, hand knitting		
• Heavy hand work: typewriting		
• Heavy work with one arm: hammering in nails (shoemaker, upholsterer)		
• Light work with two arms: filing metal, planing wood, raking garden		
• Moderate work with body: cleaning a floor, beating a carpet		
• Heavy work with body: railroad track laying, digging, barking trees		
Sample Calculation Assembly-line work using a heavy hand tool.		
A. Walking along		2.0 kcal/min
B. Intermediate value between heavy work with two arms and light work with the body		3.0 kcal/min
	Subtotal:	5.0 kcal/min
C. Add for basal metabolism		1.0 kcal/min
	Total:	6.0 kcal/min

C.4 Work-Rest Regimen

The TLVs specified in table C-1 are based on the assumption that the WBGT value of the resting place is the same or very close to that of the workplace. Where the WBGT of the work area is different from that of the rest area, a time-weighted average (TWA) value should be used for both environmental and metabolic heat.

The metabolic rate (M) should be determined by the equation:

$$\text{TWA } M = \frac{M_1 * t_1 + M_2 * t_2 + \ldots M_n * t_n}{t_1 + t_2 + \ldots + t_n}$$

where M_1, M_2 ... and M_n are estimated or measured metabolic rates for the various activities and rest periods of the worker during the time periods t_1, t_2 ... t_n (in minutes), as determined by a time study.

The TWA WBGT should be determined by the equation:

$$\text{TWA WBGT} = \frac{WBGT_1 * t_1 + WBGT_2 * t_2 + \ldots WBGT_n * t_n}{t_1 + t_2 + \ldots + t_n}$$

where $WBGT_1$, $WBGT_2$ ... and $WBGT_n$ are calculated values of WBGT for the various work and rest areas occupied during total time periods and t_1, t_2 ... t_n are the elapsed times in minutes spent in the corresponding areas, which are determined by a time study. Where exposure to hot environmental conditions is continuous for several hours or the entire workday, the TWA, that is, $t_1 + t_2 + \ldots + t_n$ equals 60 minutes. Where the exposure is intermittent, TWAs should be calculated as 2-hour TWAs, that is, $t_1 + t_2 + \ldots + t_n$ equals 120 minutes.

The TLVs for continuous work are applicable where there is a work-rest regimen of a 5-day workweek and an 8-hour workday with a short morning and afternoon break (approximately 15 minutes) and a longer lunch break (approximately 30 minutes).

Higher exposure values are permitted if additional resting time is allowed. All breaks, including unscheduled pauses and administrative or operational waiting periods during work, may be counted as rest time when additional rest allowance must be given because of high environmental temperatures.

C.5 Water and Salt Supplementation

During the hot season or when workers are exposed to artificially hot environments, drinking water should be made available in such a way that the workers are stimulated to drink one cup every 15 to 20 minutes [about 150 milliliters (mL) or 1/2 pint].

The water should be kept reasonably cool, 10°C to 15°C (50°F to 60°F), and should be placed close to the workplace so that the worker can reach it without abandoning the work area.

Workers should be encouraged to eat salted food during the hot season or when working in artificially hot environments. Salted food usually provides sufficient salt for acclimated workers. It the workers are not acclimatized or are engaged in strenuous work for several hours at a time, normal dietary salt intake may be insufficient and an electrolyte replacement drink (such as commercially available sports drinks) should be made available. An electrolyte replacement drink can be made by mixing 1 teaspoon of salt (if possible use "lite salt" which is half potassium chloride and half sodium chloride), 1/3-teaspoon baking soda (sodium bicarbonate) and 10 teaspoons of sugar (sucrose) per 1.0 liter of water. The ingredients should be completely dissolved before the water is distributed, and the water should be kept reasonably cool. Salted drinking water (0.1 percent solution) can be made available, though eating salted food is preferred as salt water is not very palatable and can cause nausea, especially in persons already experiencing symptoms of over exposure to heat. Workers should not take salt tablets unless directed to do so by a physician.

C.6 Other Considerations

C.6.1 Clothing. The permissible heat exposure TLVs are valid for light summer clothing as customarily worn by workers when working under hot environmental conditions. If special clothing is required for performing a particular job and this clothing is heavier or it impedes sweat evaporation or has higher insulation value, the worker's heat tolerance is reduced, and the permissible heat exposure TLVs indicated in table C-1 are not applicable. For each job category where special clothing is required, the permissible heat exposure TLV should be established by an expert.

Table C-4 identifies TLV WBGT correction factors for representative types of clothing.

C.6.2 Acclimatization and Fitness. Acclimatization to heat involves a series of physiological and psychological adjustments that occur in an individual during the first week of exposure to hot environmental conditions. The recommended heat stress TLVs are valid for acclimated workers who are physically fit. Extra caution must be employed when unacclimated or physically unfit workers must be exposed to heat conditions.

Table C-4. WBGT Correction Factors

Clothing Type	Clo* Value	WBGT Correction (°C)
Summer Weight Work Clothing	0.6	0
Cotton Coveralls	1.0	-2
Winter Weight Work Clothing	1.4	-4
Water Barrier, Vapor Permeable	1.2	-6
Impermeable	1.2	-10

Note:

*Insulation value of clothing. One clo = 5.55 kcal/m^2/hr of heat exchange by radiation and convection for each degree °C difference in temperature between the skin and the adjusted dry bulb temperature.

WBGT = Wet-Bulb Globe Temperature

C.6.3 Adverse Health Effects. The most serious of heat-induced illnesses is heat stroke because of its potential to be life threatening or result in irreversible damage. Other heat-induced illnesses include heat exhaustion, which in its most serious form leads to prostration and can cause serious injuries as well. Heat cramps, while debilitating, are easily reversible if properly and promptly treated. Disorders caused by excessive heat exposure include electrolyte imbalance, dehydration, skin rashes, heat edema, and loss of physical and mental work capacity.

If during the first trimester of pregnancy, a female worker's core temperature exceeds 39°C (102.2°F) for extended periods, there is an increased risk of malformation to the fetus. Additionally, core temperatures above 38°C (100.4°F) may be associated with temporary infertility in both females and males.

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APPENDIX D
COLD STRESS GUIDELINES

APPENDIX D
COLD STRESS GUIDELINES

Internal body temperature is maintained by sweating, shivering, dilation of blood vessels and capillaries in some areas of the body and constriction of blood flow in other areas. Culturally, we augment the body's physiological systems with the addition or removal of clothing and use of heated or cooled shelters. When the body is challenged by cold, it first conserves heat by curtailing blood flow to the skin. If this heat conservation measure is not adequate, involuntary muscle response (shivering) is initiated to increase body heat. If the body's physiological response to cold is unable to combat the effects of cold exposure, a number of adverse health effects can occur.

There are four basic types of cold injury: hypothermia, frostbite, frostnip, and trench/immersion foot.

D.1 Hypothermia

Hypothermia (literally "low heat") is a condition marked by an abnormally low internal body temperature. It develops when body heat is lost to a cool or cold environment faster than it can be replaced. Temperatures do not have to be below freezing for hypothermia to occur, especially in individuals with an impaired ability to maintain body temperature. Hypothermia may occur at air temperatures as high as 18.3°C (65°F) or at water temperatures as high as 22.2°C (72°F). Symptoms normally begin when the body temperature drops below 35°C (95°F). Many older adults can develop a low body temperature after exposure to conditions of mild cold, which would only produce discomfort in younger adults.

The progressively appearing symptoms of hypothermia include:

a. Shivering and foot stomping, which helps generate heat

b. Blue lips and fingers

c. Impaired coordination, dazed consciousness, confusion, disorientation, impaired judgment, reduced heart rate, and slow breathing

d. When the body temperature is between 25°C (77°F) and 32.2°C (90°F), shivering will diminish and the individual may be unable to walk or stand.

e. Below 25°C (77°F), there is failure of all heat regulatory and heat conservation mechanisms. The person becomes very sleepy or unconscious and death may occur at this stage.

D.2 Frostbite

Frostbite is a condition in which the skin freezes, causing ice crystals to form between living cells. The capillary walls of the frostbitten area are damaged, increasing cell wall permeability. Fluid is released into the tissues and is accompanied by local inflammation. The toes, fingers, nose, ears, and cheeks, are the most common sites of frostbite injury.

Signs or symptoms of frostbite, which can be superficial or deep, are:

a. In superficial frostbite, the individual experiences a loss of sensation and the skin turns gray-white. Skin may appear waxy and feel numb.

b. Deep frostbite affects the skin and the subcutaneous tissues, as well as the muscle and bone. Deep frostbite will cause numbness. The affected area will be cold, hard, and white.

D.3 Frostnip

Frostnip is a mild freezing of the top layers of skin tissue. Though sometimes painful, the effects of frostnip are easily reversed by warming the affected area.

Signs or symptoms of frostnip are:

a. Tingling in the extremities

b. Sensation of heat rather than cold.

D.4 Trench/Immersion Foot

Trench/immersion foot is caused by continuous exposure to water. It may occur anytime the feet are maintained in wet conditions for a prolonged period of time. Immersion foot can occur at relatively mild temperatures if the feet are not given an opportunity to dry. The injury can occur either because the feet are immersed in water or when a person is wearing impermeable footgear, if water or sweat collect in the boots and the feet are not allowed to dry. Minor trench/immersion foot occurs after 3 to 12 hours of exposure. Severe exposure, which lasts from 12 hours to 3 days, causes significant tissue damage.

The signs and symptoms of trench/immersion foot include:

a. Pain in the affected foot

b. Loss of color and wrinkling of skin

c. Swelling.

D.5 Risk Factors

The United States Occupational Safety and Health Administration has listed the following as major risk factors for cold-related stresses:

a. Wearing inadequate or wet clothing increases the effects of cold on the body.

b. Taking certain drugs or medications such as alcohol, nicotine, caffeine, and medication that inhibits the body's response to cold or impairs judgment

c. Having a cold or the flu, or diseases such as diabetes, heart, vascular, and thyroid disease

d. Being a male increases a person's risk to cold-related stresses. Men experience far greater death rates due to cold exposure than women, perhaps due to inherent risk-taking activities, body-fat composition, or other physiological differences.

e. Becoming exhausted or immobilized, especially due to injury or entrapment, may speed up the effects of cold weather.

f. Age – adults over 60 are more vulnerable to the effects of cold exposure.

D.6 Controls and Precautions

The best protection against cold-related health risks is to be aware of the risks and be prepared to take preventive measures. Workers should be taught to recognize the signs and symptoms of overexposure in themselves and others. Workers must be aware of and follow all of the controls and precautions listed below.

a. Ensure that workers, especially those working outdoors, understand the concept of wind-chill.

b. Ensure that workers are medically fit to work in the conditions expected at the job site.

c. Warm sweet drinks and soups should be provided at the work site. A person's thirst is suppressed in a cold environment and dehydration can increase susceptibility to cold injury. Alcohol and drinks containing caffeine should be discouraged.

d. Make sure workers understand the importance of high-caloric foods when working in cold environments. Recognize that workers in cold environments who wear heavy, protective clothing expend more heat than those working in moderate climates. As a result, these workers may require up to 15 percent more calories.

e. Require personnel working in isolated cold environments, whether indoors or outdoors, have backup. Use the "buddy" system.

f. Provide a warm-up shelter where workers can take breaks. When on break, encourage workers to remove foot gear to allow boots, socks, and feet to dry.

D.6.1 Clothing.

a. Wear several layers of clothing rather than one thick layer. Air captured between layers acts as an insulator.

b. Wear fabrics such as cotton or polypropylene next to the skin because these wick away sweat. Clothing should not restrict flexibility.

c. If conditions are wet as well as cold, ensure that the outer clothing worn is waterproof or at least water-repellent. Wind-resistant fabrics may also be required under some conditions.

d. At air temperatures of 2°C (35.6°F) or less, workers whose clothing gets wet for any reason must immediately be given a change of clothing and be treated for hypothermia.

e. Encourage the use of hats and hoods to prevent heat loss from the head and to protect the ears; 30 percent of body heat is lost through the head.

f. Tight-fitting footwear restricts blood flow. Footwear should be large enough to allow wearing either one thick or two thin pairs of socks. Wearing too many socks can tighten fit and harm rather than help.

g. Workers who get hot while working should open their jackets but keep hats and gloves on.

D.6.2 Shelter.

a. For work performed continuously in the cold, allow rest and warm-up breaks. Heated shelters such as trailers should be available nearby. Encourage workers to use these shelters at regular intervals depending on wind-chill factor.

b. Workers showing signs of shivering, frostbite, fatigue, drowsiness, irritability, or euphoria should immediately return to the shelter.

c. Workers entering the shelter should remove their outer layer of clothing and loosen other clothing to let sweat evaporate. In some cases, a change of clothing may be necessary.

D.6.3 Hand Protection. Manual dexterity is essential to safety and productivity; however, workers must comply with the following guidelines to protect the fingers and hands in cold environments.

a. Fine work performed with bare hands for more than 10 to 20 minutes in an environment below 16°C (60.8°F) requires special measures to keep workers hands warm. These measures may include warm air jets, radiant heaters (fuel burning or electric), or contact warming plates.

b. Metal handles of tools and control bars should be covered by thermal insulating material for temperatures below -1°C (30.2°F).

c. Workers should wear gloves where fine manual dexterity is not required and the air temperature falls below 16°C (60.8°F) for sedentary, 4°C (39.2°F) for light, and -7°C (19.4°F) for moderate work.

d. To prevent frostbite, workers should wear insulated gloves when surfaces within reach (especially metallic surfaces) are colder than -7°C (19.4°F). Warn workers to avoid skin contact with these surfaces.

e. Tools and machine controls to be used in cold conditions should be designed for operation by gloved hands.

D.6.4 Training. Before working in extreme cold, workers should be instructed in safety and health procedures.

Training should cover the following topics:

a. Proper clothing and equipment

b. Safe work practices

c. Guidelines for eating and drinking

d. Risk factors that increase the health effects of cold exposure

e. How to recognize signs and symptoms of frostbite

f. How to recognize signs and symptoms of hypothermia

g. Appropriate first aid treatment, including re-warming procedures.

D.7 Exposure Limits, Work Schedules, and Wind Chill

The American Conference of Governmental Industrial Hygienists (ACGIH) has adopted the guidelines developed by the Saskatchewan Labour for working outdoors in cold weather conditions. These guidelines recommend protective clothing and limits on exposure time (table D-1). The recommended exposure times are based on the wind chill factor, a scale based on air temperature and wind speed. The work-break schedule applies to any four-hour period with moderate or heavy activity. The warm-up break periods are of 10-minute duration in a warm location. The schedule assumes that "normal breaks" are taken once every two hours. At the end of a 4-hour period, an extended break (for example, lunch break) in a warm location is recommended. More information is available in the ACGIH publications "2000 TLVs and BEIs" and "Documentation of TLVs and BEIs" and on the Saskatchewan Labour web page Cold Conditions Guidelines for Outside Workers.

D.8 First Aid

If fingers or hands become either painfully cold, or have lost sensation, bring them inside your clothing against warm, bare skin.

Table D-1. TLVs Work/Warm-up Schedule for Onsite Workers Based on a 4-Hour Shift

Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx)	°F (approx)	Max. Work Period	No. of Breaks**	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	(Norm breaks) 1		(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4
-29° to -31°	-20° to -24°	(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32° to -34°	-25° to -29°	75 min.	2	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease		Non-emergency work should cease	
-38° to -39°	-35° to -39°	40 min.	4	30 min.	5	Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease	
-40° to -42°	-40° to -44°	30 min.	5	Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease	
-43° & below	-45° & below	Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease	

Notes:

* 2000 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati: American Conference of Governmental Industrial Hygienists (ACGIH), 2000 - page 176. Adopted from Saskatchewan Labour Cold Conditions Guidelines for Outside Workers.

mph = miles per hour

If toes or feet become numb or cold, get to a shelter, loosen or remove boots and socks and allow full re-warming, drying, and recovery before re-entering the cold.

If frostbite of toes or feet is suspected, do not massage or walk on them. For frostbite of fingers and hands, **do not rub or use them**. Keep cold damaged extremities immobile, protect them with warm, dry clothing, and seek medical help immediately. **Do not attempt any self-treatment beyond the following:**

a. Do not thaw hands or feet unless medical aid is distant and there is no chance of refreezing. Parts are better thawed at a hospital.

b. If medical aid is distant, warm frostbitten area gradually with body heat. **Do not rub**.

c. Apply sterile dressings to blisters to prevent breaking.

d. Get medical attention as soon as possible.

Cold-exposed people who are sleepy, lethargic, slow to respond, or who begin behaving strangely may be hypothermic. Profoundly hypothermic people will appear to be dead, even to experienced medical and paramedical professionals. **Do not attempt to treat them yourself**. Take no chances, demand emergency medical help. Until medical help arrives, do the following:

- Carefully remove casualty to shelter. Sudden movement or rough handling can upset heart rhythm.

- Gently keep casualty awake. Talk to the casualty to maintain their attention and keep them awake. Avoid strong shaking to keep the casualty awake.

- Remove wet clothing and wrap casualty in warm covers.

- Re-warm neck, chest, abdomen, and groin – but not extremities.
- Apply direct body heat (lie next to the casualty).
- Give warm, sweet drinks, but only if casualty is conscious.
- Monitor breathing. Administer artificial respiration if necessary.
- Call for medical help or transport casualty to nearest medical facility.

If trench foot or immersion foot is suspected, soak the feet in warm water, then wrap them with dry cloth bandages. Drink a warm, sugary drink. Seek medical attention.

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APPENDIX E
PERSONAL PROTECTIVE EQUIPMENT

APPENDIX E
PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) will be selected based on guidance in Department of the Army Pamphlet (DA Pam) 385-61 and 29 Code of Federal Regulations (CFR) 1910.132 and 138. Table E-1 of this annex describes PPE levels, indicating the hazards each level is designed to protect against and the equipment required to meet that level of protection. Selection of commercial protective equipment will be in accordance with DA Pam 385-61. Commercial PPE with generic approval are listed in a DA Safety memorandum dated 28 February 2002, Subject: Generic Approval of Commercial Chemical Protective Equipment.

Table E-1. Personal Protective Equipment

Description	Equipment
Level A Level A is suitable for situations where the highest level of respiratory, skin, and eye protection are desired. Level A PPE should be used in workplaces where there is a measured (or potential for) high concentrations of dusts, fumes, mists, or vapors that present a respiratory hazard and where there is a high potential for splash or immersion into chemicals that present a skin hazard. Level A PPE also should be used when working with extremely hazardous substances, DOT poison "A" materials, known or suspected human carcinogens, and infectious agents where skin contact is possible. The chemical protective items used will be selected to be compatible with the chemicals of concern against which protection is required.	Respirator • Positive pressure NIOSH-approved SCBA or tethered positive-pressure air supplied respirator with escape bottle Outer Clothing • Fully encapsulating (vapor-tight), chemical resistant suit Inner clothing • Undershirt, underwear, and socks • Coveralls (optional) Gloves • Chemical resistant over glove • Chemical resistant inner glove (part of the suit) Boots • Chemical resistant, steel toe and shank safety boot (depending on suit design, may be incorporated into the suit or worn over or under the suit boot) Communication • Intrinsically safe 2-way radio

Table E-1. Personal Protective Equipment (Continued)

Description	Equipment
Level B Level B PPE is suitable for situations where the highest level of respiratory protection is needed but a lesser level of skin protection is required. This includes environments with hazardous dust, fume, mist, or vapor concentrations exceeding the IDLH level or concentrations exceed the limits of protection afforded by a full-face air purifying respirator and where the work operations, substances, or concentrations do not represent a serious skin hazard. Level B may be used in atmospheres containing less than 19.5 percent oxygen. The type of chemical resistant clothing selected will be compatible with the chemicals of concern against which protection is required.	Respirator • Positive pressure NIOSH-approved SCBA or tethered positive-pressure air supplied respirator with escape bottle Outer Clothing • Chemical resistant clothing (overalls and long-sleeved jacket; coveralls; hooded one- or two-piece chemical splash suit; or disposable chemical resistant coveralls) Inner clothing • Undershirt, underwear, and socks (coveralls optional) • Chemical protective undergarments (optional for HD operations) Gloves • Chemical resistant outer gloves Boots • Chemical resistant (chemical resistant safety boot with steel toe and shank or a chemical resistant boot worn over safety shoes) Headgear • Hardhat (optional) Splash Protection • Face shield (optional) Communication • Intrinsically safe 2-way radio

Table E-1. Personal Protective Equipment (Continued)

Description	Equipment
Level C Level C PPE is suitable for situations where a lesser level of respiratory protection is required. Typically, the level of contamination that must be protected against has been measured and does not exceed the concentration for which the air-purifying respirator is designed and where there is little risk of splash or immersion with liquid contaminants. The type of filter used with the respirator will be selected based on the chemical(s) of concern against which protection is required. Level C PPE may not be used in situations where the oxygen concentration is below 19.5 percent.	Respirator • Full-face, air-purifying NIOSH-approved, or military mask Outer Clothing • Chemical resistant clothing (overalls and long-sleeved jacket, coveralls, hooded one- or two-piece chemical splash suit, or disposable chemical resistant coveralls Inner clothing • Undershirt, underwear, and socks • Coveralls (optional) Gloves • Chemical resistant over glove Boots • Chemical resistant, steel toe and shank safety boot (depending on suit design, may be worn over or under the suit boot) Splash Protection (optional) • Face shield • Chemical resistant apron

Table E-1. Personal Protective Equipment (Continued)

Description	Equipment
Level D Level D is suitable for situations where there is little risk of exposure to a respiratory hazard above the action level. Level D may incorporate various forms of skin protection such as gloves, boots, face shields, and aprons for situations where there is a potential skin hazard but no respiratory hazard.	Respirator • Full-face, air-purifying NIOSH-approved or military mask worn in slung position or readily available Outer Clothing • Work clothes: coveralls, laboratory coat, military uniform, or other employer issued clothing Inner clothing • Undershirt, underwear, and socks Gloves • Work gloves (optional) • Chemical resistant gloves with or without sleeves (optional) Boots • Work boot/shoe • Chemical resistant, steel toe and shank safety boot (optional) Splash Protection • Face shield (optional) • Chemical resistant apron (optional)

Notes:

DOT = Department of Transportation
IDLH = immediately dangerous to life and health
NIOSH = National Institute for Occupational Safety and Health
PPE = personal protective equipment
SCBA = self-contained breathing apparatus

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APPENDIX F
LOCKOUT AND TAGOUT PROCEDURES FOR THE EDS PHASE 1

APPENDIX F
LOCKOUT AND TAGOUT PROCEDURES FOR THE EDS PHASE 1

F.1 Purpose

Explosive Destruction System (EDS) workers will be protected from energy sources during maintenance activities by utilizing Lockout/Tagout Procedures that comply with Occupational Safety and Health Administration (OSHA) regulation 29 Code of Federal Regulations (CFR) 1910.147. This standard mandates training, audits, and recordkeeping to ensure that workers will not be injured by unintentionally energized equipment.

These procedures establish the requirements for the lockout and tagout of energy-isolating devices whenever maintenance or servicing is done on equipment associated with the EDS.

F.2 Definitions

- *Affected Employee.* An employee whose job requires him/her to operate or use any equipment on which servicing or maintenance is being performed under lockout and/or tagout; or whose job requires him/her to work in an area in which this servicing or maintenance is being performed.

- *Authorized Employee.* An employee who locks out or tags out equipment to perform servicing or maintenance. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered in this procedure and he/she has been trained in lockout and tagout procedures.

- *Control Authority.* An authorized employee administers the lockout and tagout program.

- *Energized.* Connected to an energy source or containing residual or stored energy.

- *Energy-Isolating Device.* A mechanical device that physically prevents the transmission or release of energy, such as the following:

  - Manually operated electrical circuit breaker
  - Disconnect switch
  - Line valve
  - Block.

  Note: Push buttons, selector switches, and other control circuit-type devices are not energy-isolating devices.

- *Energy Source.* Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other sources specific to EDS.

- *Lockout.* The placement of a lock, either key or combination type, on an energy-isolating device to ensure that the energy-isolating device and the equipment being controlled cannot be operated until the lock is removed.

- *Servicing and/or Maintenance.* Any work performed on the equipment to ensure ongoing performance; that is, preventive maintenance, or to repair or replace failed equipment. Note: Work on equipment that is a repetitive operating requirement; that is, opening the Containment Vessel door to remove munition parts after detonation and decontamination, and is under the direct control of operating personnel, will be covered in Standing Operating Procedures (SOPs) and are not subject to this procedure.

- *Tagout.* The placement of a Danger tag on an energy-isolating device to indicate that the energy-isolating device and the equipment being controlled may not be operated until the tag is removed.

- *Zero Energy State.* The equipment condition where every energy source has been isolated, dissipated, or blocked off and the equipment secured against accidental movement.

F.3 Responsibility for Lockout/Tagout

The EDS System Manager is responsible for the EDS lockout/tagout program for the duration of the site operations.

The EDS System Manager will:

- Authorize all maintenance activities.
- Ensure that a lock and tag plan that addresses isolation of energy sources and the means for isolating them is developed for each maintenance activity.
- Ensure that operating personnel are aware of the maintenance activity and prepare the equipment for lockout/tagout.
- Periodically audit lockout/tagout operations to ensure compliance with procedures and to evaluate the effectiveness of the lockout/tagout procedure.

The employees who will be performing the maintenance activity will be responsible for doing the required locking and tagging.

F.4 Training Requirements

Authorized employees must be trained to:

- Recognize sources of hazardous energy
- Identify the type and magnitude of energy found in the EDS
- Understand the means and methods of isolating and/or controlling energy
- Understand the means of verification of effective energy control
- Know the purpose of procedures to be used.

All affected employees must be instructed by a qualified instructor in the purpose and use of the lockout/tagout procedures.

F.5 Recordkeeping Requirements

The following records of lockout and tagout activities must be kept on file for the duration of the EDS operation:

- Personnel training records
- A log of lockout and tagout activity
- Any audit records.

F.6 Standard Lockout/Tagout Procedure

The attached Standard Lockout/Tagout Procedure will apply to the EDS operations.

STANDARD LOCKOUT/TAGOUT PROCEDURE

Requirements:

EDS maintenance personnel shall use the following special precautions when performing the standard lockout/tagout procedure:

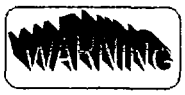
- Lock out all energy source isolating devices that are capable of being locked out. New, modified, or retrofitted equipment or systems that have hazardous energy sources shall be capable of being locked out.
- Always assume capacitors or associated equipment are energized until they are verified as deenergized.
- **Do not** use control circuit devices, such as push buttons, key interlock switches, selector switches, and door interlocks as the sole means for deenergizing circuits or equipment.
- When neutralizing energy sources, never rely on secondary protection, such as interlocks, control, or micro or limit switches that could either malfunction or be operated or bypassed without prior knowledge.

The standard lockout/tagout procedure is as follows:

Step	Action
Step 1: Notify personnel	Notify equipment operators and affected personnel in the vicinity that the equipment or system will be shut down and lockout/tagout devices will be applied.
Step 2: Preview the procedures	Preview the procedures as follows: • Check with the EDS System Manager to determine if a facility- or equipment-specific lockout/tagout procedure must be followed or if the standard lockout/tagout procedure can be used. • Review the steps of the standard lockout/tagout procedure. • Recheck to ensure that the correct system is being locked out. • Verify that the energy source isolating devices (for example, circuit breakers, disconnect switches, valves) are the correct ones for the equipment or the system on which work is performed.

Step	Action
Step 2: Preview the procedures (continued)	• Unless switches and valves are located so that their functions are obvious, make sure that all switches and valves are labeled adequately to indicate their functions. • Ensure that energy-source isolating devices will accept a lockout device. • Ensure that there are no other sources of energy that must be isolated. These are sources that could backfeed energy into the equipment (for example, batteries in uninterruptible power sources and check valves in pressure systems). • Determine if any related systems need to be shut down. • Put on any necessary personal protective equipment (PPE).
Step 3: Deenergize sources of energy	Deenergize sources of energy as follows: • Use the normal shutdown procedures to stop or turn off equipment. The equipment operator or lockout/tagout-authorized personnel may perform this task. • Locate and operate all energy-source isolating devices that control the energy to the machine or equipment to isolate the machine, equipment, or system from the energy source.
Step 4: Apply locks and tags	Apply locks and tags as follows: • Attach a personal danger tag to each lock. • Attach locks and lockout devices to energy source isolating devices to hold them in the "safe" or "off" position.
Step 5: Block or relieve stored energy sources	 **Warning:** Merely isolating energy sources is not sufficient for safety; stored electrical or mechanical energy must be neutralized. Identify and neutralize energy sources as follows: • Check all energy sources by doing any of the following that apply: - Lower suspended parts to the lowest or rest position whenever possible. - Block movable parts. - Drain or bleed pressurized liquid or hydraulic lines. - Release or block spring energy.

Step	Action
Step 5: Block or relieve stored energy sources (continued)	- Isolate external battery banks from electrical or electronic circuits. - Vent air pressure from pneumatic lines, pressure reservoirs, accumulators, and air surge tanks. If pressure cannot be relieved, block any possible movement. • Make sure that all moving parts in a danger zone have stopped before entering the area. • Review the entire cycle of the equipment's mechanical motion to avoid being caught by surprise by a sudden movement. • Discharge and ground capacitors and high-capacitance elements. • Isolate battery banks within equipment or systems to prevent circuits from reenergizing when the primary power source is deenergized (for example, battery banks of uninterruptible power systems). • Block or relieve stored nonelectrical energy in devices that could reenergize electric circuit parts. • If energy could possibly reaccumulate, continually relieve it or short it out until the accumulation is completely neutralized.
Step 6: Verify-perform final safety check	Perform the final safety check as follows: • Take voltmeter measurements at the terminals of each incoming power source and energy storage device within the equipment to verify a **zero voltage** condition. • Read the pressure gauges on equipment to verify that energy sources are disconnected and stored energy is released. • Verify that stored energy is either released or restrained. Try to restart the equipment by using the on-off and startup controls. Return the controls to the OFF position.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>Step 6: Verify-perform final safety check (continued)</td><td> 

Warning: When testing any electrical system, check test equipment for proper operation immediately before and after performing this step.
• Verify that the circuit elements and equipment parts are deenergized and, if any inadvertently induced voltage or unrelated voltage backfeed exists, test exposed circuit elements to which workers will be exposed with the appropriate test equipment.</td></tr>
<tr><td colspan="2">Servicing Equipment
 

Warning: Do not enter a danger zone until certain that:
• No hazardous motion or shock is probable.
• All energy sources are disconnected.
• Each movable part has been inspected to ensure that it is at rest.
• All tests recommended for the equipment have been performed.
• Stored energy is released, discharged, or restrained, and electrical components have been appropriately grounded.
Note: The EDS System Manager shall direct servicing activities only after verifying deenergization of equipment.</td></tr>
<tr><td colspan="2">Testing and Repositioning Equipment
In situations in which the energy-isolating devices are locked and tagged and there is a need to restart the equipment for testing or repositioning, do the following:
• Perform Step 7: Restart equipment.
• Perform testing and repositioning.
• Repeat Steps 1 through 6 before continuing servicing activities to reverify that isolation and deenergization have been accomplished and to continuously relieve energy that may reaccumulate.</td></tr>
<tr><td>Step 7: Restart equipment</td><td>Restart equipment as follows:
• Notify the equipment operator and anyone in the vicinity that the equipment is being restarted.
• Warn anyone who may be exposed to the hazards associated with reenergizing equipment to stay clear of the equipment.
• Ensure the following:
- A lockout/tagout-authorized person conducts the necessary tests and visual inspections to verify that all tools, electrical jumpers, shorts, grounds, and other such devices are removed so that the circuits and equipment can be safely energized.</td></tr>
</table>

Step	Action
Step 7: Restart equipment (continued)	- The required servicing is complete and the equipment is in operating condition. - All guards are in place. - Any braces, pins, locks, chains, or other restraints have all been removed and movable parts are unblocked. - All pressure tubing, pipes, and hoses are reconnected, and equipment or system valves are set to their appropriate closed or open position. - All tools, parts, and debris are removed from the system and the work area is clear. - Everyone is clear of potential danger zones. - Everyone in the area is wearing required PPE for normal operations. • Remove locks, lockout devices, and tags. • Be alert for possible movements that may take place when the equipment is reenergized. • Operate energy-source isolating devices in the sequence identified in the equipment-specific procedure. • Reenergize the equipment or system through normal starting procedures. The equipment operator or a lockout/tagout-authorized person can perform this task.
Step 8: Notify personnel of reenergization	Notify anyone who may be affected by reenergization that the process has been completed and that the equipment has been reenergized.

EQUIPMENT-SPECIFIC LOCKOUT/TAGOUT PROCEDURE

Requirements:

The EDS System Manager shall ensure that equipment-specific procedures comply with the requirements in this document and, at a minimum, shall document the steps for the following activities:

- Notify affected individuals.
- Preview procedures.
- Apply locks and tags.
- Identify and neutralize energy sources.
- Perform final safety check.
- Restart equipment.

LOCK AND TAG REMOVAL WHEN THE WORKER WHO APPLIED THEM IS ABSENT

Requirements:

Note: In normal circumstances, only the lockout/tagout-authorized worker who originally attached the lock and tag shall remove it. However, if that worker is unavailable (for example, is on vacation or sick leave), the manager or a designee named on the back of the danger tag may assign another worker to complete the servicing and to restart the equipment.

Managers shall ensure that the following procedure is used to remove locks and tags in the absence of the worker who attached them:

Warning: Leaving a voice message or sending an e-mail to inform an individual that their locks and tags have been removed **does not constitute "informing the individual" and is a violation of federal law.**

Step	Action
1	Verify that the worker whose locks and tags are to be removed is **not** at the facility before removing the devices.
2	Make all reasonable efforts to contact the worker at home and to determine the status of the work and the reasons that the worker who attached the lock and tag did **not** remove them.
3	Notify affected personnel that responsibility for lockout/tagout is being transferred.
4	Have another lockout/tagout-authorized worker remove the lock and tag. **Note:** The lock may be removed with bolt cutters or other metal-cutting tools.
5	Have the worker who completes the servicing activities install another lock and tag and conduct final safety checks per Step 6 of the standard lockout/tagout procedure (see "Standard Lockout/Tagout Procedure"), including reverification of deenergization prior to any work on the equipment, process, or system.

Step	Action
6	Ensure that the worker whose locks are removed is informed of the removal either by telephone or immediately upon when the worker's return to work.
7	Document manager-authorized lock removal.

ANNUAL INSPECTIONS

Performing Annual Lockout/Tagout Implementation Inspections

Requirements:

Managers shall ensure that annual inspections of **all** activity- or equipment-specific lockout/tagout procedures and their implementation are conducted.

A lockout/tagout-authorized person other than those who use the lockout/tagout procedure being assessed (for example, a lockout/tagout-authorized worker from another department) shall conduct the inspection. This reviewer shall:

- Ensure that the procedures comply with the latest revision of this document and that any changes in the equipment or system that may have occurred are properly reflected in the procedures.
- Check that personnel training is current.
- Observe a demonstration of the procedures.
- Identify and document inadequacies observed in the procedure and its implementation.
- Verify that lockout/tagout procedures are being followed exactly as documented.
- Review the responsibilities of all authorized personnel (and all affected personnel if tagout-only procedures are used) under the lockout/tagout procedure. The reviewer may accomplish this by holding group meetings with authorized personnel.

Correcting Deviations or Inadequacies

Requirements:

EDS Managers shall ensure that any deviations or inadequacies observed in procedures, training, or implementation are corrected before the lockout/tagout procedure is performed again.

Documentation of Annual Inspections

A lockout/tagout-authorized person other than those who use the lockout/tagout procedure being assessed (for example, a lockout/tagout-authorized worker from another department) shall document the annual inspection findings and corrective actions.

Requirements:

Managers shall document annual inspections, including:

- The name of the equipment or facility for which the lockout/tagout procedure is written
- Date of the review
- Names of the lockout/tagout-affected and -authorized personnel included in the review
- Statement of review findings, deficiencies, and corrective actions required
- Name of the person who performed the review.

MANAGER'S SELF-ASSESSMENT OF LOCKOUT/TAGOUT

Guidance:

Managers should:

- Evaluate the adequacy of their lockout/tagout implementation with regard to OSHA and DOE requirements by performing a self-assessment against pre-established criteria.
- Use the Lockout/Tagout Self-Assessment form (SF 2001-LSA) to complete and record the results of the lockout/tagout self-assessment.

REFERENCES

Requirements Source Documents:

29 CFR 1910.147, *The Control of Hazardous Energy (Lockout/Tagout).*

DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

Implementing Documents:

SNL, MN471001, *ES&H Manual*, Section 4C, "Lockout/Tagout for the Control of Hazardous Energy."

Related Documents:

29 CFR 1910.269, *Electric Power Generation, Transmission, and Distribution.*

29 CFR 1910.333, *Selection and Use of Work Practices.*

29 CFR 1926.417, *Lockout and Tagging of Circuits.*

ANSI/NFPA 70E, *Electrical Safety Requirements for Employee Work Places*, 1995.

DOE-STD-1030-96, *Guide to Good Practices for Lockouts and Tagouts.*

SNL, MN471001, *ES&H Manual*, Chapter 21, *Technical Work Documents (TWDs).*

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APPENDIX G
REFERENCES

APPENDIX G
REFERENCES

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American Society for Testing and Materials (ASTM), *Standard Test Method for Surface Burning Characteristics of Building Materials*, ASTM-E84-00, August 2000.

Code of Federal Regulations (CFR), Title 29-Labor, Part 1910: *Occupational Safety and Health Standards*.

29 CFR 1926, *Safety and Health Regulation for Construction*.

40 CFR 264, *Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*.

Department of the Army Pamphlet (DA Pam) 385-61, *Toxic Chemical Agent Safety Standards*.

Edgewood Chemical Biological Center (ECBC), *Final Report for Testing of Steel Arch Confinement Structure for 4.7" Chemical Munitions Hazards*, June 1994.

National Fire Protection Association (NFPA), *701, Fire Tests for Flame Resistant Textiles and Film*, current edition.

Occupational Safety and Health Administration (OSHA), *OSHA Technical Manual*, TED 1-0.15A, January 1999.

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U.S. Army, Army Regulation (AR) 40-5, *Preventive Medicine*.

U.S. Army Technical Bulletin (TB) 43-0142, *Safety Inspection and Testing of Lifting Devices*, 30 August 1993.

U.S. Army TB MED 501/DLAM 1000.2, *Occupational and Environmental Health: Respiratory Protection Program*.

U.S. Army TB MED 503, *Occupational and Environmental Health: The Army Industrial Hygiene Program*.

APPENDIX H
EMERGENCY ALARM AND EVACUATION PLAN

APPENDIX H
EMERGENCY ALARM AND EVACUATION PLAN

This appendix identifies essential and non-essential personnel, identifies communications systems, and outlines pre-planned actions that will take place in the event of an emergency during movement of an item to the Explosive Destruction System (EDS) or during operations of the EDS.

H.1 Essential Personnel

Essential personnel are those designated personnel necessary to perform critical activities during an emergency situation involving hazardous materials. Essential personnel include:

- Edgewood Chemical Biological Center (ECBC) personnel
  - Monitoring
  - Operations
  - Command Post person
  - Cascade operator.
- TEU personnel
  - Explosive Ordnance Disposal (EOD)
  - Personnel Decontamination Station (PDS).

- Product Manager for Non-Stockpile Chemical Materiel (PMNSCM) Site Representative
  - System Manager
  - Site Safety and Health Officer (SSHO)
  - System Operations Manager
  - Tennessee Valley Authority (TVA) representative (when serving as PMNSCM representative).
- Medical personnel (Medical personnel are designated as essential personnel; however, they will report to the rally point with their ambulance during an emergency situation.)
- Primary Data Collector
- Sandia National Laboratory site representative
- Dugway Proving Ground (DPG) Site Safety Representative.

H.2 Non-essential Personnel

Non-essential personnel are those designated onsite personnel that are not required to support operations during an emergency situation. Non-essential personnel will report to the designated rally point and include the following persons:

- All visitors

- Secondary data collector (when present)

- TVA representative (when not serving as PMNSCM representative).

H.3 Communications

The primary means of communication among crew members is the EDS crew radio system. The individual crew radio is worn on a belt and includes a microphone and earpiece designed for use with respiratory protection. Also, there is a land line to the Monitoring Room that is connected to the crew radio system so the Monitoring Operator can communicate without using a radio while in close proximity to the MINICAMS®. Additional means of communication can include word-of-mouth, hand-held radios, cellular telephones, hand signals, and the alarm horn.

H.3.1 Hand-Held Radios

Hand-held radios will be located at the following locations:

- Command Post

  - One radio utilizing same frequency on hand-held radios used by EDS crew

  - A second radio on frequency used by EDS Site Safety Representative, Medics, and Rally Point Guard.

- Vapor Containment System (VCS) EDS Crew Chief

- PDS

- Monitoring Room (used by Monitoring Operator when he/she is away from the Monitoring Room)

- DPG Site Safety Representative has their assigned radio
- Medics have their assigned radio.

H.3.2 Communication During Emergency Response

- EDS Crew Radio System is primary
- Hand-held radios
- Cellular/mobile telephones (primarily for communications with agencies/organizations not at the EDS site and not on the radio net).

H.4 Emergencies During Item Movement

If there is an emergency during movement of an item from storage to the EDS, the emergency will be communicated via radio and word-of-mouth. Additional instructions will be issued by the Command Post via radio (crew radio system and hand-held radio) and the following actions will be taken:

- All non-essential personnel move to rally point with slung mask
- EOD personnel
  - Move munition
  - Report personnel accountability/status (injuries).
- Standby operators
  - Report to break trailer

- Report personnel accountability
- EDS Crew Chief is with EOD personnel (moving munition).

• PDS personnel

- Report to PDS
- Report personnel accountability.

• Monitoring Room

- Report to monitoring room
- Report personnel accountability.

• Medical personnel

- Stationed with ambulance
- Report personnel accountability.

• Command Post personnel

- Essential personnel (other than those listed previously) report to Command Post (non-essential are evacuated)
- EDS System Manager accounts for personnel in Command Post.

H.6 Alarms at EDS Site

H.6.1 Level 1 Alarm – 1 blast of air horn.

A Level 1 Alarm **(1 blast of air horn)** is sounded when two out of three near real-time (NRT) monitors in the VCS are in the alarm state or when there is any other indication of contaminated air in the VCS. The Monitoring Operator will notify the Command Post of the Level 1 Alarm condition and the Command Post will issue one blast on the air horn. The Command Post will also use the Crew Radio System to communicate instructions. When the alarm sounds, the following actions will take place:

- Non-essential personnel will report to the designated rally point with slung mask. Rally points will be designated in the daily safety briefing
- SSHO or designated individual – with slung mask
  - Report to rally point
  - Conduct roll call and compare with site roster
  - Report personnel accountability to Command Post.
- Medical personnel
  - Report with ambulance at rally point.
- VCS operators
  - Report to PDS
  - Stand by for alarm confirmation or if all clear given, return to VCS.

- PDS personnel
  - Don masks
  - Prepare to process personnel
  - Report personnel accountability.
- Monitoring personnel – report to Monitoring Room and stay in place
  - Report personnel accountability.
- Standby personnel (VCS operators, EOD personnel) report to Personal Protective Equipment (PPE) Room
  - ECBC team leader (not in VCS) report personnel accountability
  - Assist with confirmation of alarm or other duties.
- Command Post personnel
  - Essential personnel remain in place
  - Verify all personnel are accounted for.

H.6.2 Level 2 Alarm – 2 blasts of air horn.

A Level 2 Alarm **(2 blasts of air horn)** is sounded when there is a loss of engineering control when a potential release has occurred. When the Command Post becomes aware that a Level 2 Alarm condition exists, they will issue two blasts on the air horn. All personnel in Level D PPE will don masks. Personnel in a higher level of PPE (A, B, or C) will remain in that level of PPE. The Command Post will issue instructions to the

crew using the Crew Radio System and the following preplanned actions will be initiated:

- Command Post will check wind direction and provide information to DPG Safety Representative.
- SSHO or designated individual
  - Escort non-essential personnel to rally point.
- Operations personnel inside the VCS
  - Report to PDS (unless already there)
  - Don masks if not already masked.
- PDS personnel
  - Don masks
  - Stand by to process personnel.
- Command Post personnel
  - Don masks
  - Direct response personnel prepare for response
  - Make emergency notifications.

- Monitoring
  - Don masks
  - Maintain communication with Command Post
  - Stand by to collect dosimeter badges/confirmation tubes – confirm alarm (if directed).
- Standby operators (report to PPE Room if not already present)
  - Don masks
  - Prepare for work party duties
  - Relieve other team members (PDS, etc) as directed.
- Medics
  - Don turn-out gear/response gear and remain on standby.
- Accountability of personnel is the same as level 1 alarm.